1

DOT/FAA/CT-89/16

**FAA Technical Center**
Atlantic City International Airport
N.J. 08405



# Study of the Engine Bird Ingestion Experience of the Boeing 737 Aircraft

## (October 1986 - September 1987)

Peter W. Hovey
Donald A. Skinn

University of Dayton Research Institute
Dayton, Ohio

October 1989

Interim Report





U.S. Department of Transportation
**Federal Aviation Administration**

**Technical Report Documentation Page**

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| DOT/FAA/CT-89/16 | | |

| 4. Title and Subtitle | 5. Report Date |
|---|---|
| A STUDY OF THE ENGINE BIRD INGESTION EXPERIENCE OF THE BOEING-737 AIRCRAFT (October 1986 - September 1987) | October 1989 |
| | 6. Performing Organization Code: DOT/FAA/CT-89/16 |
| 7. Author(s): Peter W. Hovey and Donald A. Skinn | 8. Performing Organization Report No.: UDR-TR-88-137 |
| 9. Performing Organization Name and Address: University of Dayton Research Institute, Structural Integrity Division, 300 College Park (JPC-201), Dayton, Ohio 45469 | 10. Work Unit No. (TRAIS) |
| | 11. Contract or Grant No.: DTFA03-88-C-00024 |
| 12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, Technical Center, Atlantic City International Airport, NJ 08405 | 13. Type of Report and Period Covered: Interim Report: Medium/Large Inlet Area Engines - October 1986 - September 1987 |
| | 14. Sponsoring Agency Code: ACD-210 |

**15. Supplementary Notes**

FAA Contract Monitors: Howard Banilower FAA Technical Center
Joseph Wilson FAA Technical Center

**16. Abstract**

The Federal Aviation Administration (FAA) Technical Center initiated a study in October 1986 to determine the numbers, sizes, and types of birds which are being ingested into medium and large inlet area turbofan engines and to determine what damage, if any, results. Bird ingestion data are being collected for the Boeing-737 model aircraft which uses either the Pratt and Whitney JT8D medium inlet area turbofan engine or the CFM International CFM56 large inlet area turbofan engine. This interim report analyzes the first of 3 years of data collection. The first year extends from October 1986 through September 1987. Keywords:

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Bird Ingestion, Aircraft CFM56, CFM56, JT8D, Turbofan Engine, Turbine Engine, Probability of Ingestion, Statistical Analysis. (U) | Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161 |

| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| Unclassified | Unclassified | 100 | |

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

## FOREWORD

This interim report provides descriptive and statistical analyses of the data collected over a 1-year period on bird ingestion experiences for the B737 aircraft. The data described in this report were collected under a separate contract by the engine manufacturers.

The report was prepared by the University of Dayton under Department of Transportation, Federal Aviation Administration Contract DTFA03-88-C-00024. The technical project monitors for the FAA during the preparation of the report were Dr. Howard Banilower and Mr. Joseph Wilson. The principal investigator at the University of Dayton was Dr. Peter W. Hovey, and computer support was provided by Mr. Donald A. Skinn.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

## EXECUTIVE SUMMARY

An investigation was initiated by the Federal Aviation Administration Technical Center in September 1986 to determine the numbers, weight, and species of birds which are ingested into medium and large inlet area turbofan engines during worldwide service operation and to determine what damage, if any, results. This interim report summarizes the first of 3 years of Boeing-737 data being collected to support this effort.

A total of 2.75 million aircraft operations were flown by Boeing-737 commercial aircraft during the first year of this investigation which extended from October 1986 through September 1987. Boeing-737 aircraft equipped with Pratt and Whitney JT8D medium inlet area turbine engines accounted for 80.8 percent of these flights. The remaining 19.2 percent of the flights were made by aircraft having CFM International CFM56 large inlet area turbofan engines.

A total of 314 engine ingestion events were reported during the first year of data collection. There were 5.49 million engine operations during this same period which yield a probability of engine ingestion of $5.72 \times 10^{-5}$. A conclusion of these data is that bird ingestion events are rare, but probable, events.

When the species of the ingested bird was reliably identified, gulls were determined to be the most commonly ingested birds. The majority of ingested birds (30 of 37) weighed less than 40 ounces. The bird weight distribution of ingested birds in the United States was different from the distribution in foreign countries. The mean, median, and mode weights of ingested birds were larger in the United States than abroad. The bird ingestion rate within the United States was significantly lower than the foreign bird ingestion rate.

The majority (123 of 144) of aircraft ingestion events, for which the phase of flight was known, occurred within the airport environment during takeoff and landing. There were 39 engine ingestions which resulted in engine damage classified as moderately severe or worse. The majority of bird ingestions resulted in little or no engine damage. The majority of aircraft ingestion events (273 of 302) involved a single bird and a single engine on the aircraft. The remaining 29 aircraft ingestion events involved multiple birds and/or multiple engines.

The following is a summary of the most pertinent statistics extracted from the first year of data for the Boeing-737 aircraft:

| | |
|---|---|
| Total Engine Ingestion Events | 314 |
| Total Aircraft Ingestion Events | 302 |
| Average Bird Weight (oz) | |
| United States | 20.7 |
| Foreign | 11.1 |
| Median Bird Weight (oz) | |
| United States | 14 |

| | |
|---|---|
| Foreign | 9 |
| Probability of Ingestion Per Aircraft Operation | |
| Worldwide | $1.10 \times 10^{-4}$ |
| United States | $0.53 \times 10^{-4}$ |
| Foreign | $1.79 \times 10^{-4}$ |
| Most Commonly Ingested Bird | |
| United States | Dove/Gull |
| Foreign | Gull/Lapwing |
| Engines Experiencing Moderate/Severe Damage | 39 |
| Multiple Bird Ingestion Events | 20 |
| Multiple Engine Ingestion Events | 12 |
| Aircraft Ingestion Events By Phase-of-Flight | |
| Takeoff and Climb Phase-of-Flight | 56.9% |
| Approach and Landing | 30.6% |
| Airports Reporting Bird Ingestions | 137 |
| Ratio of Reported Events to Aircraft Operations | |
| United States | $0.53 \times 10^{-4}$ |
| Foreign | $1.79 \times 10^{-4}$ |

## SECTION 1

## INTRODUCTION

### 1.1 BACKGROUND.

Contention for airspace between birds and airplanes has created a serious bird/aircraft strike hazard. A past study [1] has indicated that birdstrikes to engines are statistically rare events. The probability of a birdstrike during any given flight is extremely low; however, when the number of flights is considered, the number of birdstrikes becomes significant.

The windshield and the engines are particularly vulnerable to the birdstrike threat. Although penetration of the windshield by a bird is primarily a concern for military airplanes operating at high speeds in a low-altitude environment, such a penetration has occurred on a civilian airplane resulting in the death of the co-pilot. Ingestion of birds into airplane engines is a problem for commercial as well as military jet airplanes for it can cause significant damage to the engine resulting in degraded engine performance and possible failure.

In his study of bird ingestions on commercial flights, Frings [1] indicated that nearly all bird ingestion events have occurred in the vicinity of airports during the non-cruise phases of flight. This is understandable because these phases of flight naturally occur closer to the ground where bird concentrations are higher, resulting in a higher probability of birdstrike.

The solutions to the problem of engine damage resulting from bird ingestion are similar to those for windshield birdstrike, e.g., structural design consideration to withstand impact or bird avoidance. Bird avoidance can be facilitated by either of two approaches: (1) keeping airplanes out of airspaces with large bird concentrations, or (2) removing birds from these regions of airspace. Neither bird avoidance approach is well-suited to commercial air fleets because flight schedules place airplanes in specific areas at specific times and the effectiveness of airport bird control programs (if any) varies from airport to airport and country to country.

Structural design of engines to withstand bird ingestions can be accomplished provided that requirements with respect to bird sizes and numbers can be identified. Bird ingestion data for medium/large inlet area turbofan engines and small inlet area turbine engines are currently being collected by several engine manufacturers. Statistical evaluation of bird ingestion data from these data collection efforts and previous bird ingestion studies will be useful in re-evaluating certification test criteria specified in FAA regulation 14 CFR 33.77. As a result, future jet engines can be designed to withstand more realistic bird threats.

### 1.2 OBJECTIVES.

The objective of this interim report is to determine the relationship of bird weight, geographic location, season, time of day, phase of flight, and engine type to the frequency of bird ingestion events and the extent of engine damage, if any, resulting from the ingested birds. The statistical analysis of reported bird ingestions experienced by commercial Boeing-737 (B737) airplanes worldwide over 1-year reporting period (October 1986 through September 1987) is used to summarize the service threat and level of engine damage experienced by these airplanes. The findings of the analysis will be helpful in defining minimum engine design requirements for resistance to damage as a result of bird ingestions. Moreover, this study will provide a comparison between the experiences of a contemporary high-bypass ratio turbofan engine (CFM56) and an older low-bypass ratio turbofan engine with a smaller inlet (JT8D) exposed to similar aircraft-bird ingestion environments.

## 1.3 ORGANIZATION OF REPORT.

Section 2 defines, discusses, and differentiates airport operations and aircraft operations. Section 3 identifies the characteristics and behavior of bird species that have been ingested and reliably identified. Section 4 describes bird ingestion rates by location, engine type, and phase of flight. Section 5 provides a geographic placement of bird ingestion events throughout the world. Section 6 summarizes engine damage resulting from bird ingestions. Section 7 examines the probabilities of various bird ingestion events. Section 8 provides a summary of the results obtained during this phase of data analysis.

## SECTION 2

## AIRCRAFT OPERATIONS AND AIRPORT OPERATIONS

Aircraft and airport operations data are used to determine bird ingestion rates. Operations data (and their sources) used to generate bird ingestion rates are discussed in this section. A Glossary is provided to aid in understanding these data.

An aircraft *operation* as defined in the glossary is a nonstop flight from one airport (departure airport) to another airport (arrival airport) and consists of 8 phases of flight which include (1) taxi-out, (2) takeoff, (3) climb, (4) cruise, (5) descent, (6) approach, (7) landing, and (8) taxi-in. An airport operation is considered either a departure from or an arrival at an airport. When all scheduled flights are considered, the number of airport operations is twice the number of aircraft operations.

The Official Airline Guide (OAG) is the data source for scheduled airport operations. Counts of airport operations involving B737 airplanes were extracted from OAG magnetic tapes and maintained by airport code. The counts were further categorized by month of year and hour of day so that seasonal and time-of-day analyses could be performed.

Table 2.1 presents the OAG airport operations counts by seasonal months. The counts are also broken down by several geographic regions. Table 2.2 presents the same airport operations counts as table 2.1; however, an adjustment for hemisphere has been made. It should be noted that the number *of aircraft* operations for each of these categories is one-half the number of airport operations.

Table 2.3 cross tabulates airport operations for each month of the reporting period by OAG destination-arrival code in two ways. The first tabulation includes all airports at which one or more B737 operations were scheduled during the reporting period. The second tabulation is a subset of the first and includes only those airports at which a bird ingestion event was reported during the period. The destination-arrival code is taken directly from the OAG tapes, and its values are presented as a footnote in table 2.3.

A breakdown of aircraft operations by engine type and geographic region is required to obtain bird ingestion rates for these parameters. Table 2.4 presents a breakdown of B737 aircraft operations by engine type and geographic region for the reporting period. The OAG operations data identify implicitly the geographic region through the airport code and also identify explicitly whether the airplane is a B737; however, the engine type of the airplane is not reliably identified in the OAG data. The aircraft operations presented in the ALL ENGINES column of table 2.4 are derived by dividing the airport operations in the TOTAL column of table 2.1 by 2. The aircraft operations for the CFM56 engine were provided by the engine manufacturer as actual flights flown during the reporting period and are considered reliable. Similar data were not available for the JT8D engine. The JT8D aircraft operations were therefore derived by subtracting the CFM56 aircraft operations from the total aircraft operation for both engines.

TABLE 2.1 SCHEDULED OAG AIRPORT OPERATIONS BY SEASONAL MONTH

| | SEASONAL MONTHS | | | | |
|---|---|---|---|---|---|
| GEOGRAPHIC LOCATION | MAR-MAY | JUN-AUG | SEP-NOV * | DEC-FEB | TOTAL |
| Contiguous US | 728,180 | 762,922 | 685,560 | 681,306 | 2,857,968 |
| United States | 771,231 | 807,492 | 726,309 | 722,461 | 3,027,493 |
| Foreign | 619,425 | 647,640 | 604,935 | 591,679 | 2,463,679 |
| Northern Hemisphere | 1,235,767 | 1,296,951 | 1,181,268 | 1,166,794 | 4,880,780 |
| Southern Hemisphere | 154,889 | 158,181 | 149,976 | 147,346 | 610,392 |
| Worldwide | 1,390,656 | 1,455,132 | 1,331,244 | 1,314,140 | 5,491,172 |

* SEP87, OCT86, and NOV86 combined as Autumn (Northern Hemisphere) and Spring (Southern Hemisphere)

TABLE 2.2 SCHEDULED OAG AIRPORT OPERATIONS BY SEASON

| | SEASONS OF THE YEAR | | | | |
|---|---|---|---|---|---|
| GEOGRAPHIC LOCATION | SPRING † | SUMMER | AUTUMN † | WINTER | TOTAL |
| Contiguous US | 728,180 | 762,922 | 685,560 | 681,306 | 2,857,968 |
| United States | 771,231 | 807,492 | 726,309 | 722,461 | 3,027,493 |
| Foreign | 614,512 | 636,805 | 609,848 | 602,514 | 2,463,679 |
| Northern Hemisphere | 1,235,767 | 1,296,951 | 1,181,268 | 1,166,794 | 4,880,780 |
| Southern Hemisphere | 149,976 | 147,346 | 154,889 | 158,181 | 610,392 |
| Worldwide | 1,385,743 | 1,444,297 | 1,336,157 | 1,324,975 | 5,491,172 |

† SEP 87, OCT86, and NOV86 combined as Autumn (Northern Hemisphere) and Spring (Southern Hemisphere)

TABLE 2.3 OAG AIRPORT OPERATIONS BY MONTH

ALL AIRPORTS WITH SCHEDULED B737 OPERATIONS

| MONTH | OAG DESTINATION-ARRIVAL CODES ** | | | | | |
|---|---|---|---|---|---|---|
| | (0) | (1) | (2) | (3) | (4) | (Total) |
| OCT'86 | 193,968 | 231,432 | 2,880 | 0 | 3,074 | 431,354 |
| NOV'86 | 189,972 | 227,934 | 2,498 | 0 | 2,974 | 423,378 |
| DEC'86 | 200,544 | 242,892 | 2,916 | 42 | 3,614 | 450,008 |
| JAN'87 | 201,148 | 245,030 | 2,856 | 102 | 3,514 | 452,650 |
| FEB'87 | 180,814 | 225,126 | 2,620 | 96 | 2,826 | 411,482 |
| MAR'87 | 202,102 | 253,710 | 3,092 | 88 | 2,758 | 461,750 |
| APR'87 | 200,608 | 249,398 | 3,172 | 120 | 2,730 | 456,028 |
| MAY'87 | 207,444 | 258,486 | 3,718 | 158 | 3,072 | 472,878 |
| JUN'87 | 205,696 | 256,952 | 3,854 | 68 | 3,144 | 469,714 |
| JUL'87 | 215,568 | 269,914 | 3,680 | 174 | 3,412 | 492,748 |
| AUG'87 | 215,770 | 269,582 | 3,686 | 196 | 3,436 | 492,670 |
| SEP'87 | 212,012 | 257,798 | 3,544 | 162 | 2,996 | 476,512 |
| TOTAL | 2,425,646 | 2,988,254 | 38,516 | 1,206 | 37,550 | 5,491,172 |

AIRPORTS EXPERIENCING BIRD INGESTIONS DURING REPORTING PERIOD

| MONTH | OAG DESTINATION-ARRIVAL CODES ** | | | | | |
|---|---|---|---|---|---|---|
| | (0) | (1) | (2) | (3) | (4) | (Total) |
| OCT'86 | 70,533 | 106,978 | 1,397 | 0 | 436 | 179,344 |
| NOV'86 | 71,139 | 105,585 | 936 | 0 | 409 | 178,069 |
| DEC'86 | 74,190 | 112,612 | 1,160 | 21 | 447 | 188,430 |
| JAN'87 | 74,233 | 114,171 | 1,266 | 51 | 422 | 190,143 |
| FEB'87 | 67,670 | 104,265 | 1,122 | 48 | 361 | 173,466 |
| MAR'87 | 75,326 | 116,536 | 1,102 | 44 | 400 | 193,408 |
| APR'87 | 75,889 | 115,078 | 1,056 | 60 | 400 | 192,483 |
| MAY'87 | 79,106 | 118,677 | 1,166 | 105 | 468 | 199,522 |
| JUN'87 | 78,199 | 118,057 | 1,307 | 42 | 454 | 198,059 |
| JUL'87 | 81,903 | 123,270 | 1,290 | 118 | 473 | 207,054 |
| AUG'87 | 81,915 | 122,813 | 1,230 | 134 | 467 | 206,559 |
| SEP'87 | 82,407 | 115,762 | 1,229 | 108 | 430 | 199,936 |
| TOTAL | 912,510 | 1,373,804 | 14,261 | 731 | 5,167 | 2,306,473 |

** -0 **Any Carrier**. Operation begins and ends out of the US.
-1 **Domestic Carrier**. Operation begins and ends in the US.
-2 **Domestic Carrier**. Departure or arrival, but not both, in the US.
-3 **Foreign Carrier**. Operation begins and ends in the US.
-4 **Foreign Carrier**. Departure or arrival, but not both, in the US.

The FAA initially provided UDRI with a listing of reported aircraft operations by month and engine type. The total number of aircraft operations for each engine type was later deemed questionable. Monthly percentages were determined for each engine type from the listing and subsequently applied to the JT8D and CFM56 engine totals in table 2.4 to estimate monthly aircraft operations for the reporting period. Figure 2.1 is a histogram showing the estimated aircraft operations for each engine type.

TABLE 2.4 SCHEDULED AIRCRAFT OPERATIONS BY ENGINE TYPE

| GEOGRAHIC LOCATION | JT8D | CFM56 | ALL ENGINES |
|---|---|---|---|
| United States | 1,160,091 | 353,656 | 1,513,747 |
| Foreign | 1,057,633 | 174,206 | 1,231,839 |
| Worldwide | 2,217,724 | 527,862 | 2,745,586 |

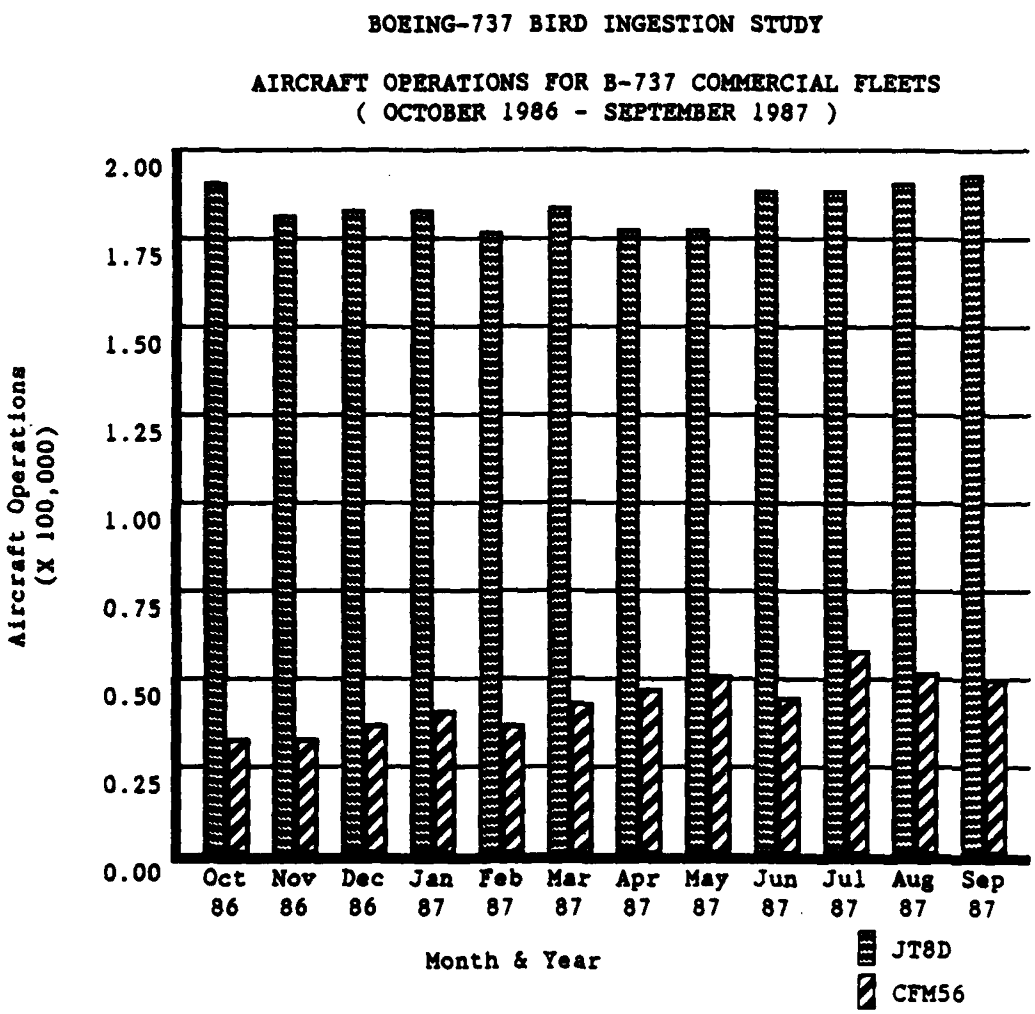


Figure 2.1 Histogram of Aircraft Operations by Month and Engine Type

## SECTION 3

## CHARACTERISTICS OF INGESTED BIRDS

This section provides a description of the birds that were ingested during the data collection period and an analysis of the extent of the bird ingestion threat. The bird related features that are described in this section include species, weight, seasonal trends, time-of-day trends, and geographic location.

A detailed breakdown of aircraft ingestion events in the United States is presented in figures 3.1 and 3.2. Figure 3.1 is a contour map of the contiguous United States with the height of the contours being proportional to the number of aircraft ingestion events in each state while figure 3.2 is a bar chart with the same information plus Alaska and Hawaii. Texas and California have the greatest number of ingestions followed by Florida, North Carolina, and New York.

Table 3.1 provides a tally of all the species that were positively identified by an ornithologist during the collection period. The counts in the United States, Foreign, and Overall columns of table 3.1 indicate the number of aircraft ingestion events in which each bird species was ingested. The species are listed by order and family; and it is apparent that gulls, doves and the lapwing/plover family are the most commonly ingested birds with six ingestions each. Doves and gulls were the most commonly ingested bird in the United States while the lapwings appear to be mainly a foreign species.

One of the disappointing features of the B737 bird ingestion data base is the low bird identification rate. The bird species was positively identified in only 28 out of 302 aircraft ingestion events that were recorded giving a 9.3 percent identification rate. The identification rate for events in which the engine sustained damage was slightly better (12.5 percent) than the identification rate for events which caused no engine damage (5.2 percent); which could indicate that the group of identified birds is biased to include more birds in the size and weight ranges that tend to damage engines when ingested. Any conclusions about the population of ingested birds should be viewed with the caution that the sample might be more representative of the population of birds that damage engines than of all birds that are ingested.

The species-related descriptions of ingested birds in this report probably provide a conservative view in that the birds that caused damage are better represented in the sample than birds that did not cause damage. The bird features that influence damage cannot be discerned, however, because of the possible bias in the identifications. That is, the differences between the birds that cause damage and the birds that don't cause damage cannot be readily identified since there is less information about the birds that didn't cause damage.

Table 3.2 is a frequency table of weights for the positively identified birds. The numbers in table 3.2 represent the total number of ingested birds. It should be noted that 2 was used as the number of birds when the exact number of positively identified ingested birds is unknown for a multiple bird ingestion event. The bird weights are derived from the species identification and when possible are adjusted for the age and sex of the ingested bird. The modes in table 3.2 therefore represent the weights of the more commonly identified bird

CONTOUR MAP OF CONTINENTAL US BIRD INGESTION EVENTS

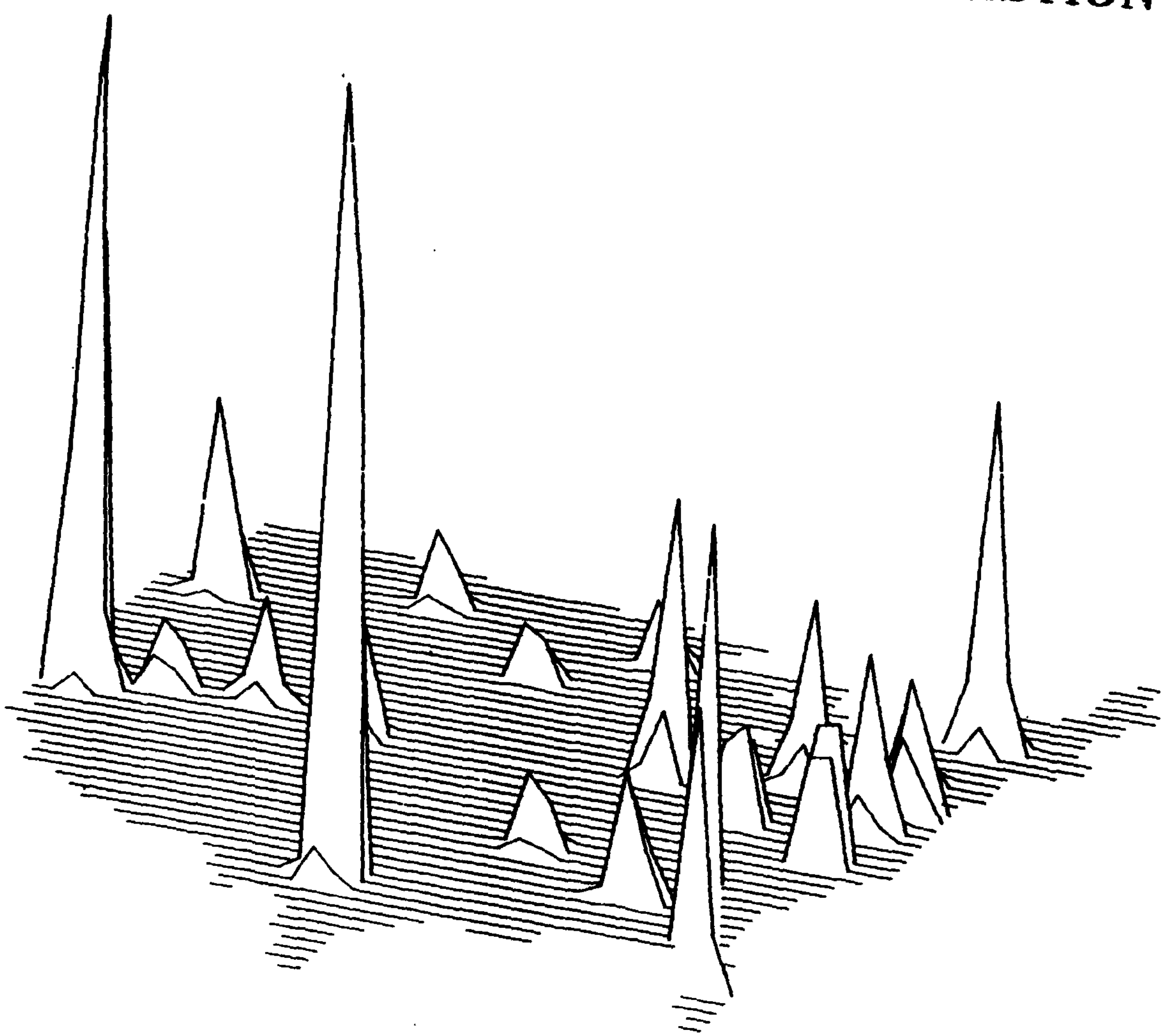

Figure 3.1 Contour Map of Domestic Bird Ingestion Events

BOEING-737 BIRD INGESTION STUDY

HISTOGRAM OF BIRD INGESTION BY STATE

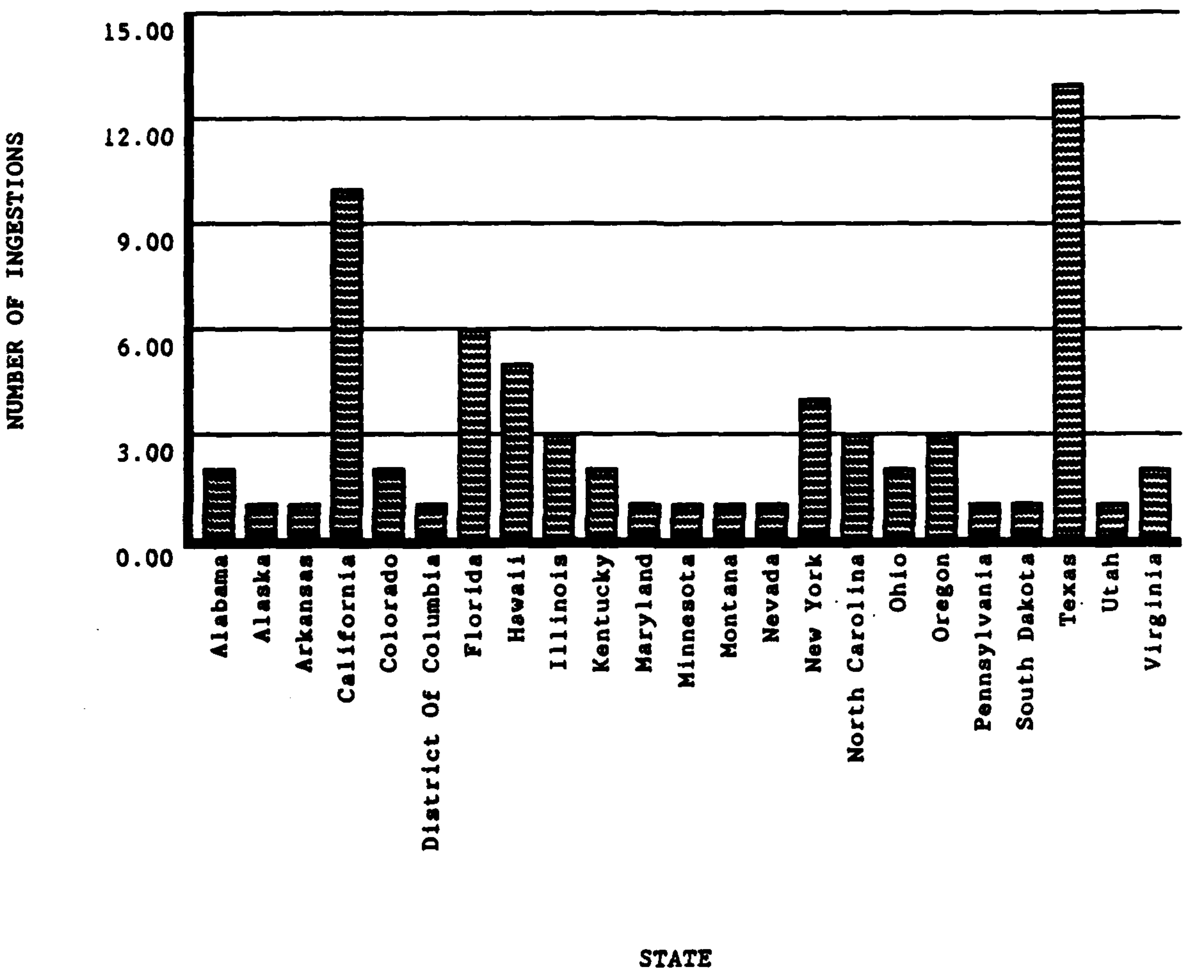


Figure 3.2 Bar Chart of Aircraft Ingestion Events by State

TABLE 3.1 TALLY OF POSITIVELY IDENTIFIED BIRD SPECIES
BROKEN DOWN BY US, FOREIGN, AND OVERALL

| Latin Name | Common Name | Species Code | US | Foreign | Overall |
|---|---|---|---|---|---|
| Bubulcus ibis | Cattle egret | 1I35 | 0 | 1 | 1 |
| Branta canadensis | Canada goose | 2J30 | 1 | 0 | 1 |
| Anas platyrhynchos | Mallard | 2J84 | 1 | 0 | 1 |
| Pandion haliaetus | Osprey | 2K1 | 1 | 0 | 1 |
| Circus cyaneus | Northern marsh harrier | 3K78 | 1 | 0 | 1 |
| Accipiter striatus | Sharp-shinned hawk | 3K105 | 1 | 0 | 1 |
| Falco sparverius | American kestrel | 5K26 | 1 | 0 | 1 |
| Vanellus melanopterus | Black-winged plover | 5N10 | 0 | 1 | 1 |
| Vanellus vanellus | Gray-headed lapwing | 5N20 | 0 | 2 | 2 |
| Pluvialis apricaria | Eurasian golden plover | 5N25 | 1 | 0 | 1 |
| Charadrius vociferus | Killdeer | 5N33 | 0 | 1 | 1 |
| Burhinus capensis | Cape dikkop | 9N4 | 0 | 1 | 1 |
| Larus delawarensis | Ring-billed gull | 14N12 | 1 | 0 | 1 |
| Larus argentatus | Herring gull | 14N14 | 2 | 0 | 2 |
| Larus glaucescens | Glaucous-winged gull | 14N22 | 1 | 1 | 2 |
| Larus ridibundus | Common black-headed gull | 14N36 | 0 | 1 | 1 |
| Columba livia | Common rock dove | 2P1 | 2 | 1 | 3 |
| Streptopelia chinensis | Spotted dove | 2P65 | 1 | 0 | 1 |
| Coccyzus americanus | Yellow-billed cuckoo | 2R51 | 1 | 0 | 1 |
| Chordeiles minor | Nighthawk | 5T5 | 1 | 0 | 1 |
| Eremophila alpestris | Horned lark | 17Z74 | 1 | 1 | 2 |
| Sturnus vulgaris | Common starling | 21Z75 | 1 | 0 | 1 |
| | | | 18 | 10 | 28 |

TABLE 3.2 WEIGHT DISTRIBUTION OF INGESTED BIRDS

| WEIGHT RANGE (Oz) | U.S. | FOREIGN | WORLDWIDE |
|---|---|---|---|
| ( 0 < x <= 4) | 8 | 3 | 11 |
| ( 4 < x <= 8) | 3 | 2 | 5 |
| ( 8 < x <= 12) | 0 | 3 | 3 |
| ( 12 < x <= 16) | 7 | 3 | 10 |
| ( 16 < x <= 20) | 1 | 0 | 1 |
| ⋮ | | | |
| ( 36 < x <= 40) | 3 | 1 | 4 |
| ⋮ | | | |
| ( 52 < x <= 56) | 2 | 0 | 2 |
| ⋮ | | | |
| (124 < x <= 128) | 1 | 0 | 1 |
| TOTAL | 25 | 12 | 37 |

species that were ingested. Figure 3.3 provides the same information in the form of a histogram. Most of the ingested birds that were identified in this study weighed less than 16 ounces; however 21.6 percent of the identified birds weighed more than 1 pound.

Summary statistics calculated from the raw data for the United States, foreign and worldwide bird weight distributions are presented in table 3.3. The mean, median and mode are three different concepts for the typical or average value which measures the central tendency of the distribution. The median and mode are more relevant measures of the average for the bird ingestion problem. The mean weight would be important if damage were related to the cumulative weight of all birds ingested by a single engine since the mean is based on the total weight of the ingested birds.

A pattern suggestive of a sine function is seen in figure 3.4 which is a bar chart of monthly bird ingestions for the data collection period. A cyclic pattern in aircraft ingestion events is expected since bird activity is seasonal; however, a second year of data is required to show that the periodic property in the pattern of monthly ingestion events repeats. The start of a cyclic pattern is also seen in the ingestion rate data which indicate that the trends are due to the changing bird population and not changes in air traffic activity. Time trends in bird ingestions are further investigated on a seasonal basis in the following paragraphs.

The seasonal bird ingestion rates for the northern and southern hemispheres, the United States and foreign countries, and the whole world are presented in the bar chart of figure 3.5. Here the ingestion rates are not being compared by engine type so the ingestion rate R is simply calculated as:

$$R = Ing \cdot \frac{10000}{Ops} \qquad 3.1$$

where Ing is the number of ingestions and Ops is the number of aircraft operations in the time period being considered. The rate is expressed as ingestions per 10,000 aircraft operations.

Seasonal trends were investigated using a Chi-squared goodness-of-fit (GOF) analysis. The Chi-squared value for testing the hypothesis "that the number of aircraft ingestion events does not vary with the seasons" is 22.22. The critical value for testing at the five percent level of significance is 7.81 while the 0.5 percent level is 12.8; therefore, the high value of the test statistic is a strong indication that ingestions do vary with the seasons.

The winter data were eliminated in an effort to better identify the nature of the differences between the seasons. Testing for the equality of the ingestions for spring, summer, and autumn also yields a significant difference with a test statistic of 6.05 and a five percent critical value of 5.99. After eliminating the data from the next lower season, there is no detectable difference between summer and autumn so that the data indicate that there are the fewest ingestions in the winter, followed by an increase in ingestions in the spring, with the maximum number of ingestions occurring during the summer and carrying through the autumn.

TABLE 3.3 SUMMARY STATISTICS FOR INGESTED BIRD WEIGHTS

| STATISTIC | UNITED STATES (oz.) | FOREIGN (oz.) | WORLDWIDE (oz.) |
|---|---|---|---|
| MODE(S) | 14 | 9 | 14 |
| MEDIAN | 14 | 9 | 10 |
| MEAN | 20.7 | 11.1 | 17.6 |
| STANDARD DEVIATION | 27.8 | 10.3 | 23.9 |

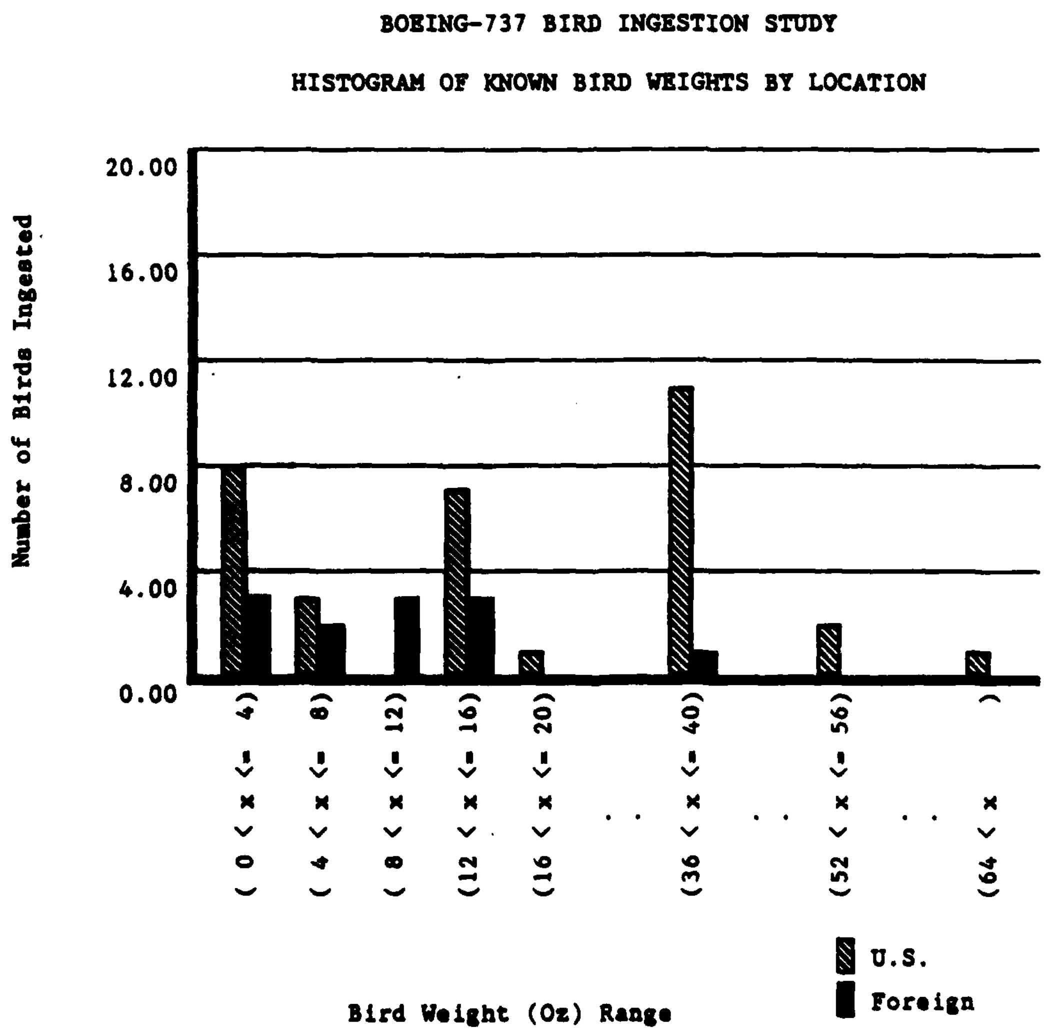


Figure 3.3 Historgram of Number of Birds Ingested by Bird Weight

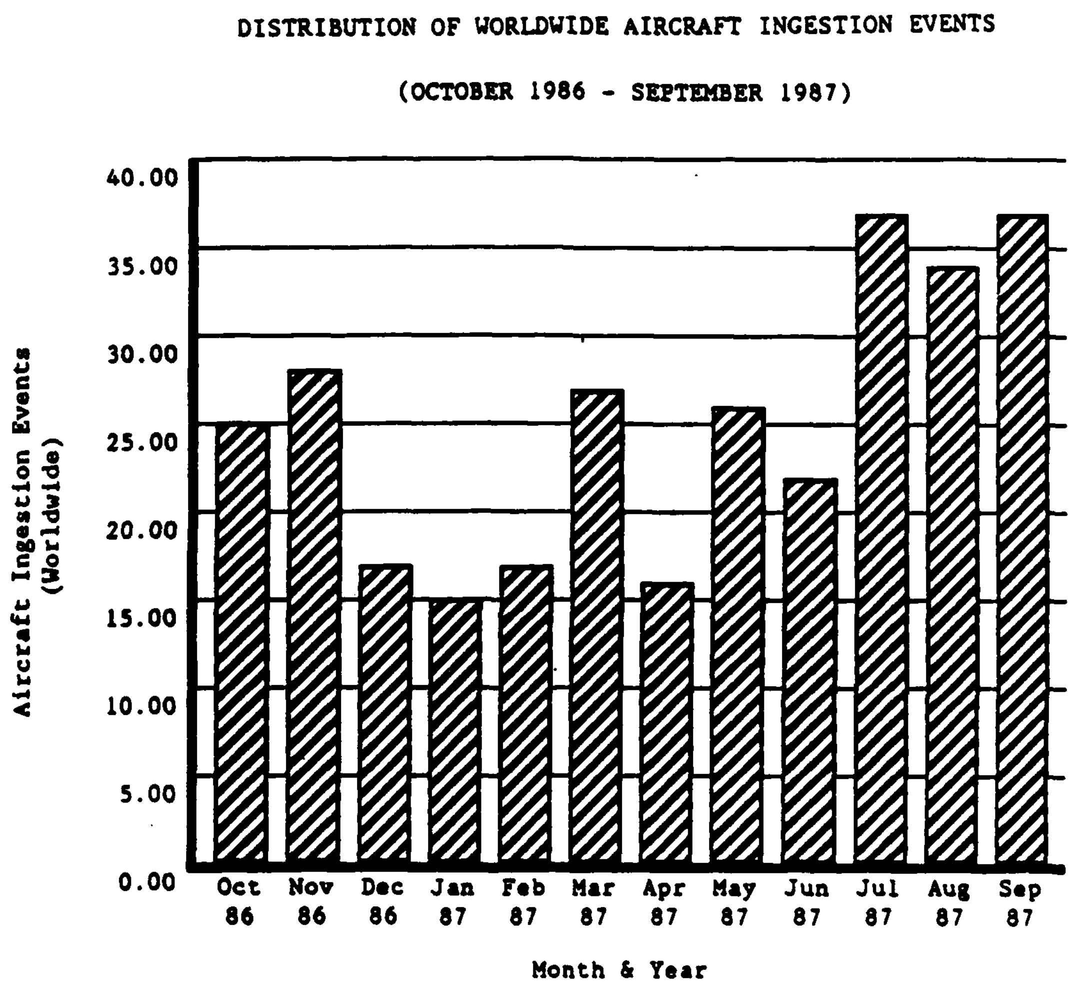


Figure 3.4 Bar Chart of Worldwide Aircraft Ingestion Events

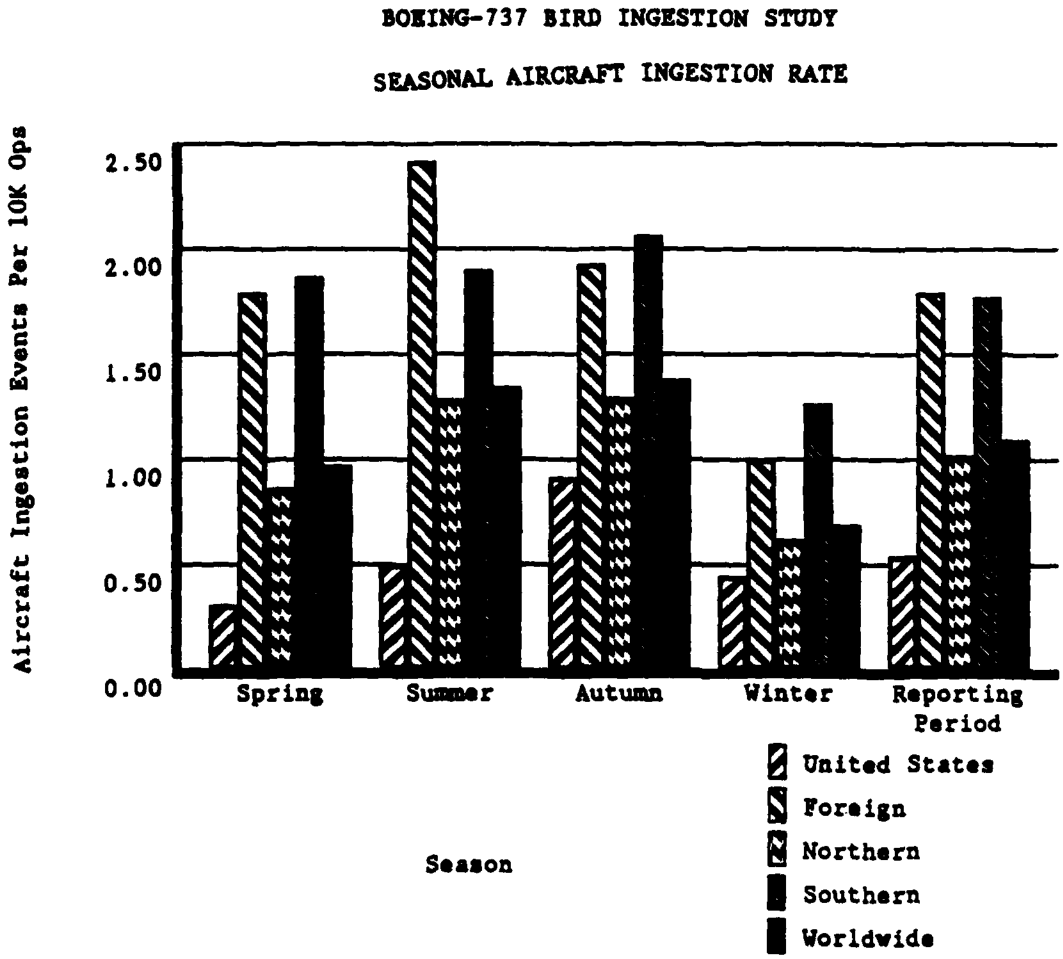


Figure 3.5 Seasonal Aircraft Ingestion Rates

The time-of-day distribution of bird ingestion events is illustrated in figure 3.6 with time of day reduced to the four basic segments of morning, mid-day, evening, and night. There is a noticeable drop in the number of ingestions at night and the Chi-squared test for equality of the four time periods indicates that they are not the same. The Chi-squared test statistic is 12.1 while the 99th percentile of the Chi-squared with three degrees of freedom distribution is 11.34.

There are two likely reasons for a drop in ingestions during the night. Birds are not generally nocturnal so that bird activity is reduced at night. Also, there are fewer flights scheduled at night. A lessened exposure due to fewer flights and fewer birds results in a reduction in the number of ingestions at night.

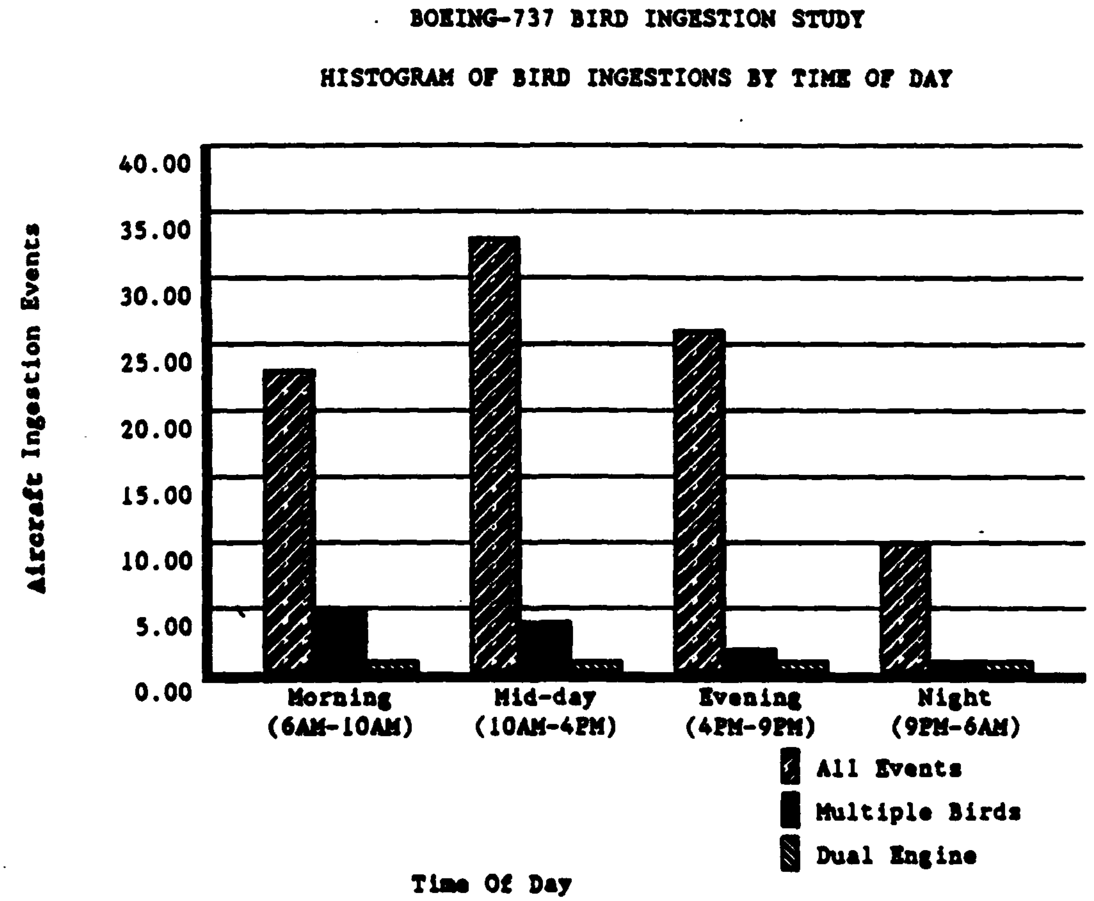


Figure 3.6 Histogram of Aircraft Ingestion Events by Time of Day

## SECTION 4

## INGESTION RATES

This section describes the rates at which bird ingestions occurred during the 1-year collection period covered in this report. The Poisson distribution is commonly used to describe how events are randomly scattered in time, and the bird ingestion data are shown to agree with the assumptions of a Poisson process. The first part of this section provides the estimates of the basic ingestion rates. The second part describes the Poisson distribution and how it relates to the bird ingestion events. The final parts discuss statistical analyses based on the assumption that bird ingestions follow a Poisson process.

### 4.1 INGESTION RATE ESTIMATES.

This section provides a general description of ingestion rates broken down by location, engine, and phase of flight. The rates are given in terms of ingestions per 10,000 aircraft operations and have been adjusted to the inlet area of the engine to allow size independent comparisons between engines. The inlet area used throughout this report is called the "fat lip area" and was specified by the Boeing Co. for each type of engine installation. A more detailed statistical analysis of ingestion rates is covered in the next section using statistical techniques for Poisson processes.

Table 4.1A lists the United States, foreign and worldwide ingestion rates for both the JT8D and the CFM56 engines as well as a composite rate for all 737 aircraft. The inlet area adjustment was done using a 10-square-foot unit area on the basis of the total inlet area of both engines to keep the rates in a reasonable range. The composite rates in each geographical region are weighted means of the inlet area adjusted rates for the individual engines and are determined as follows. The number of ingestions per 10-square-foot inlet area for each engine is projected by multiplying the rates by the number of aircraft operations. The composite rates are calculated by dividing the total projected ingestions for both engines by the total aircraft operations for the geographical region. Table 4.1B lists engine ingestion rates based on engine operations and normalized for the engine inlet area.

The ingestion rates for the CFM56 engine were calculated using reported aircraft operations for specific geographical regions. The ingestion rates for the JT8D engine were calculated using estimated aircraft operations for specific geographical regions. The details of the calculation were presented in Section 2.

Figure 4.1 shows monthly ingestion rates subdivided by engine type and adjusted for inlet area so that a comparison between engine types can be made. The adjusted monthly ingestion rate ($R_{adj}$) for an engine type is expressed as ingestions per 10 $ft_2$ per 10,000 aircraft operations is calculated as:

$$R_{adj} = Ing \cdot \frac{1440}{2IA} \cdot \frac{1000}{Ops} \qquad 4.1$$

where Ing is the number of monthly aircraft ingestion events for an engine type, IA is the inlet area ($in^2$) of the engine type, and Ops is the number of aircraft

TABLE 4.1A BREAKDOWN OF BIRD INGESTION RATES BY ENGINE AND LOCATION (BASED ON AIRCRAFT OPERATIONS)

| ENGINE TYPE: | JT8D | CFM56 | ALL ENGINES |
|---|---|---|---|
| INLET AREA:* | 2234 $in^2$ | 4606 $in^2$ | N/A |
| UNITED STATES | | | |
| Aircraft Ingestion Events | 40 | 40 | 81 |
| OAG Aircraft Operations | 1,160,091 | 353,656 | 1,513,747 |
| Ingestion Rate (Ing/10K Ops) | 0.34 | 1.13 | 0.54 |
| Normalized Ingestion Rate (Ing/10K Ops/10$ft^2$) | 0.22 | 0.35 | 0.25 |
| FOREIGN | | | |
| Aircraft Ingestion Events | 173 | 48 | 221 |
| OAG Aircraft Operations | 1,057,633 | 174,206 | 1,231,839 |
| Ingestion Rate (Ing/10K Ops) | 1.64 | 2.76 | 1.79 |
| Normalizes Ingestion Rate (Ing/10K Ops/10$ft^2$) | 1.05 | 0.86 | 1.03 |
| WORLDWIDE | | | |
| Aircraft Ingestion Events | 213 | 88 | 302 |
| OAG Aircraft Operations | 2,217,724 | 527,862 | 2,745,586 |
| Ingestion Rate (Ing/10K Ops) | 0.96 | 1.67 | 1.10 |
| Normalizes Ingestion Rate (Ing/10K Ops/10$ft^2$) | 0.62 | 0.52 | 0.60 |

*Total Area for 2 Engines

TABLE 4.1B BREAKDOWN OF BIRD INGESTION RATES BY ENGINE AND LOCATION (BASED ON ENGINE OPERATIONS)

| ENGINE TYPE: | JT8D | CFM56 | ALL ENGINES |
|---|---|---|---|
| INLET AREA:* | 1117 $in^2$ | 2303 $in^2$ | N/A |
| UNITED STATES | | | |
| Engine Ingestion Events | 43 | 43 | 87 |
| OAG Engine Operations** | 2,320,182 | 707,312 | 3,027,494 |
| Ingestion Rate (Ing/10K Ops) | 0.19 | 0.61 | 0.29 |
| Normalized Ingestion Rate (Ing/10K Ops/10ft$^2$) | 0.24 | 0.38 | 0.28 |
| FOREIGN | | | |
| Engine Ingestion Events | 175 | 52 | 227 |
| OAG Engine Operations** | 2,115,266 | 348,412 | 2,463,678 |
| Ingestion Rate (Ing/10K Ops) | 0.83 | 1.49 | 0.92 |
| Normalizes Ingestion Rate (Ing/10K Ops/10ft$^2$) | 1.07 | 0.93 | 1.05 |
| WORLDWIDE | | | |
| Engine Ingestion Events | 218 | 95 | 314 |
| OAG Engine Operations** | 4,435,448 | 1,055,724 | 5,491,174 |
| Ingestion Rate (Ing/10K Ops) | 0.49 | 0.90 | 0.57 |
| Normalizes Ingestion Rate (Ing/10K Ops/10ft$^2$) | 0.63 | 0.56 | 0.62 |

*Area for 1 Engine

** Engine Operations = 2 x Aircraft Operations

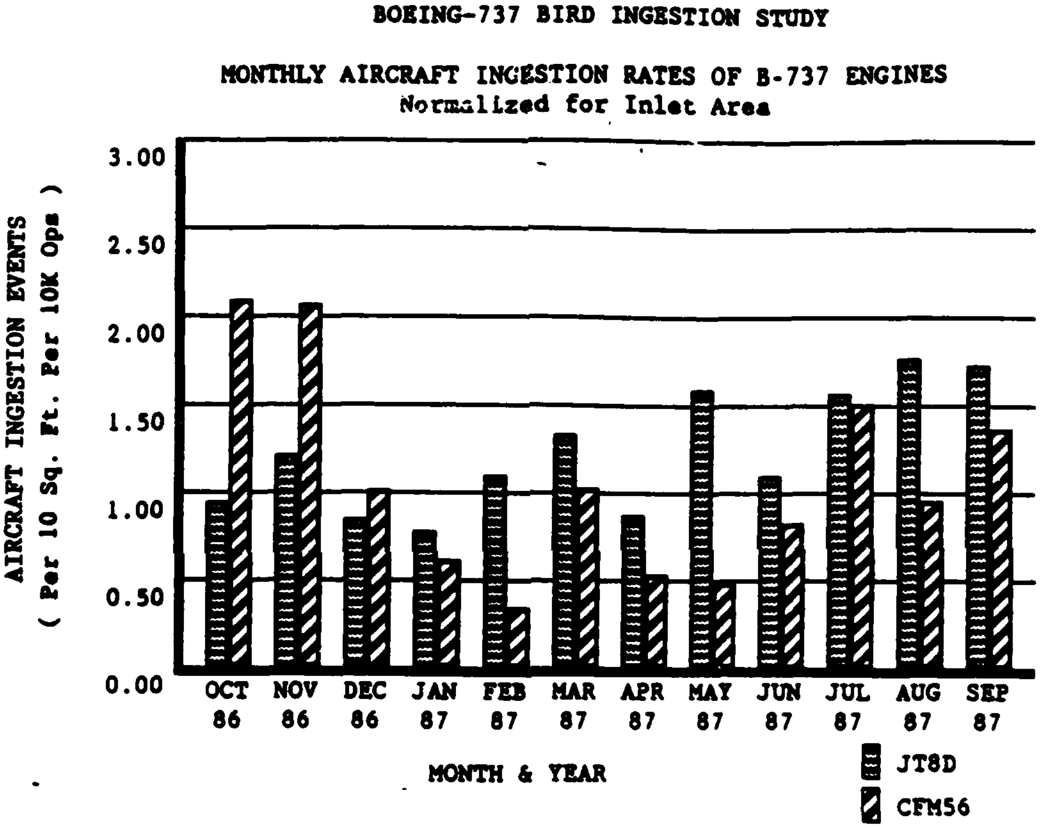


Figure 4.1 Histogram of Monthly Aircraft Ingestion Rates by Engine Type

operations for the month. Twice the engine area is used because there are two engines on each B737 aircraft. The constant 1440 is the factor for converting square inches to units of 10 square feet areas.

The phase of flight ingestion rate breakdown is presented in table 4.2A. The method used to calculate ingestion rate 1 is expressed in equation 3.1. The area adjustment used for ingestion rate 2 is implemented using equation 4.1. The highest ingestion rates were in the takeoff and landing phases followed by the climb and approach phases. There were very few ingestions during the taxi and cruise phases of flight and none were reported during descent. This pattern is typically seen in bird strike and bird ingestion studies and is indicative of the fact that airports are often located in desirable bird environs. Since birds congregate around airports there is a greater chance of striking or ingesting a bird during the phases of flight that take place close to the airports. Also, commercial airline cruise routes are well above the altitude in which birds are usually found. Table 4.2B list engine ingestion rates as a function of phase of flight. The differences in injestion rates between table 4.2A and 4.2B are due to multiple engine ingestions.

## 4.2 THE POISSON PROCESS.

The Poisson process is the simplest type of stochastic process which describes how events are distributed in time. The Poisson process is here taken to govern ingestion events, and the times at which these events occur are random. In a Poisson process the events are distributed somewhat evenly in time so that it appears the times at which the events occurred form a uniform distribution. This section describes some of the properties of Poisson processes that will be useful in describing bird ingestions and in testing hypotheses about bird ingestion rates.

The basis of a Poisson process is a description of the probability distribution of the number of events that occur in a given time interval. The formula for the probability of n events in an interval of length T is:

$$P(X(T)=n) = \frac{e^{-\lambda T}(\lambda T)^n}{n!} \qquad 4.2$$

The parameter $\lambda$ is the mean rate at which events occur and the mean number of events in the length T time interval is $\lambda T$. The time scale that will be used in this study is number of aircraft operations. Ingestion rates are typically reported in events per 10,000 aircraft operations which implies the use of aircraft operations as the time scale in a Poisson process.

One derivation of the formula for the Poisson distribution is the limiting distribution of the binomial distribution for large sample sizes. If we assume that the probability of a bird ingestion is the same from flight to flight, then the number of ingestions in a large number of flights has a binomial distribution. If the probability of ingestion is p and the number of flights is N then the probability that n ingestions occur in the N flights is:

$$P(X(N)=n) = \frac{N}{n} p^n(1-p)^{(N-n)} \qquad 4.3$$

TABLE 4.2A INGESTION RATES FOR ENGINE TYPE BY PHASE OF FLIGHT
(BASED ON AIRCRAFT OPERATIONS)

| | PRATT-WHITNEY JT8D | | | CFMI CFM56 | | | ALL ENGINES | | |
|---|---|---|---|---|---|---|---|---|---|
| INLET* AREA | 2234 $in^2$ | | | 4606 $in^2$ | | | --- | | |
| AIRCRAFT OPERATIONS | 2,217,724 | | | 527,862 | | | 2,745,586 | | |
| PHASE OF FIGHT | AIRCRAFT ING. EVENTS | INGEST RATE 1 ** | INGEST RATE 2 # | AIRCRAFT ING. EVENTS | INGEST RATE 1 ** | INGEST RATE 2 # | AIRCRAFT ING. EVENTS | INGEST RATE 1 ** | INGEST RATE 2 ## |
| Taxi | 1 | .005 | .003 | 2 | .038 | .012 | 3 | .011 | .005 |
| Takeoff | 87 | .392 | .253 | 27 | .512 | .160 | 115 | .419 | .235 |
| Climb | 9 | .041 | .025 | 9 | .171 | .053 | 18 | .066 | .031 |
| Cruise | 0 | ---- | ---- | 1 | .019 | .006 | 1 | .004 | .001 |
| Approach | 11 | .050 | .032 | 6 | .114 | .036 | 17 | .062 | .033 |
| Landing | 36 | .162 | .105 | 18 | .341 | .107 | 54 | .197 | .105 |
| Unknown | 69 | .311 | .201 | 25 | .474 | .148 | 94 | .342 | .190 |
| All Phases | 213 | .960 | .619 | 88 | 1.677 | .521 | 302 | 1.100 | .600 |

* Total Area of 2 Engines
** Ingestion Events per 10,000 Operations
\# Ingestion Events Per 10,000 Operations Per 10 $ft^2$
\## Function of JT8D Rate 2, CFM56 Rate 2, and Corresponding Operations

TABLE 4.2B INGESTION RATES FOR ENGINE TYPE BY PHASE OF FLIGHT
(BASED ON ENGINE OPERATIONS)

| | PRATT-WHITNEY JT8D | | | CFMI CFM56 | | | ALL ENGINES | | |
|---|---|---|---|---|---|---|---|---|---|
| INLET AREA* | 1117 $in^2$ | | | 2303 $in^2$ | | | --- | | |
| ENGINE OPERATIONS | 4,435,448 | | | 1,055,724 | | | 5,491,174 | | |
| PHASE OF FIGHT | ENGINE ING. EVENTS | INGEST RATE 1 ** | INGEST RATE 2 # | ENGINE ING. EVENTS | INGEST RATE 1 ** | INGEST RATE 2 # | ENGINE ING. EVENTS | INGEST RATE 1 ** | INGEST RATE 2 ## |
| Taxi | 1 | .002 | .003 | 2 | .019 | .012 | 3 | .005 | .005 |
| Takeoff | 90 | .203 | .262 | 29 | .275 | .172 | 120 | .219 | .244 |
| Climb | 9 | .020 | .026 | 9 | .085 | .053 | 18 | .033 | .031 |
| Cruise | 0 | ---- | ---- | 1 | .009 | .006 | 1 | .002 | .001 |
| Approach | 12 | .027 | .035 | 7 | .066 | .041 | 19 | .035 | .036 |
| Landing | 36 | .081 | .105 | 21 | .199 | .124 | 57 | .104 | .108 |
| Unknown | 70 | .158 | .203 | 26 | .246 | .154 | 96 | .175 | .194 |
| All Phases | 218 | .491 | .634 | 95 | .900 | .563 | 314 | .572 | .622 |

* Area of 1 Engine
** Ingestion Events per 10,000 Operations
\# Ingestion Events Per 10,000 Operations Per 10 $ft^2$
\#\# Function of JT8D Rate 2, CFM56 Rate 2, and Corresponding Operations

The binomial probabilities in equation 4.3 can be approximated by a Poisson distribution with mean Np for large values of N. That is, the single flight probability of an ingestion, p, replaces $\lambda$ in equation 4.2.

An important question that can be investigated through the Poisson process model of bird ingestions is the influence of inlet area on the ingestion rates. Past studies (2,3) in bird strikes have used the assumption that the probability of a bird strike is proportional to the cross sectional area of the aircraft. Applying the same concept to engines implies that the bird ingestion rate should be proportional to the inlet area of the engine.

The inlet area effect can be incorporated into the Poisson process model by letting the parameter represent the ingestion rate per unit area. The probability of n ingestions in N operations for an engine with inlet area A is:

$$P(X(N)=n) = \frac{e^{-\lambda AN}\,(\lambda AN)^n}{n!} \qquad 4.4$$

## 4.3 VALIDITY OF THE POISSON PROCESS MODEL FOR BIRD INGESTIONS.

The applicability of the Poisson process model can be tested by analyzing the times between ingestions. The interarrival times in a Poisson process are random variables that have independent exponential distributions and the mean time between arrivals is the reciprocal of the ingestion rate. The validity of the Poisson process model can be tested by applying a goodness-of-fit (GOF) test for the exponential distribution to the times between ingestions.

The times between ingestions are measured by the number of days between aircraft ingestion events. Normally the number of aircraft operations between aircraft ingestion events would be used; however it is impossible to measure this directly. The number of days between aircraft ingestion events provides a suitable measure of the time between ingestions since the number of aircraft operations has little day-to-day variability.

The GOF test for the exponential distribution is a modified Kolmogorov-Smirnov (K-S) test comparing the observed cumulative distribution function (CDF) to the predicted exponential CDF based on the sample mean. The K-S test uses the test statistic D defined as the maximum distance between the observed and predicted cumulative distribution functions. A modification to the critical values for the test statistic is required when the predicted CDF is derived from the mean of the sample. The critical values for the modified K-S test were computed by Liliefors (4). The critical value for a .05 level of significance when the sample size, n, is larger than 30 can be approximated by $1.06/\sqrt{n}$.

The modified K-S test was run on four subgroups of the data broken down by engine and location. The four groups were (1) domestic (United States) JT8D, (2) foreign JT8D, (3) domestic CFM56, and (4) foreign CFM56. Figures 4.2 to 4.5 compare the observed and predicted cumulative distributions for each of the four groups, respectively. In each case there is a very close visual agreement between the observed and predicted CDF's.

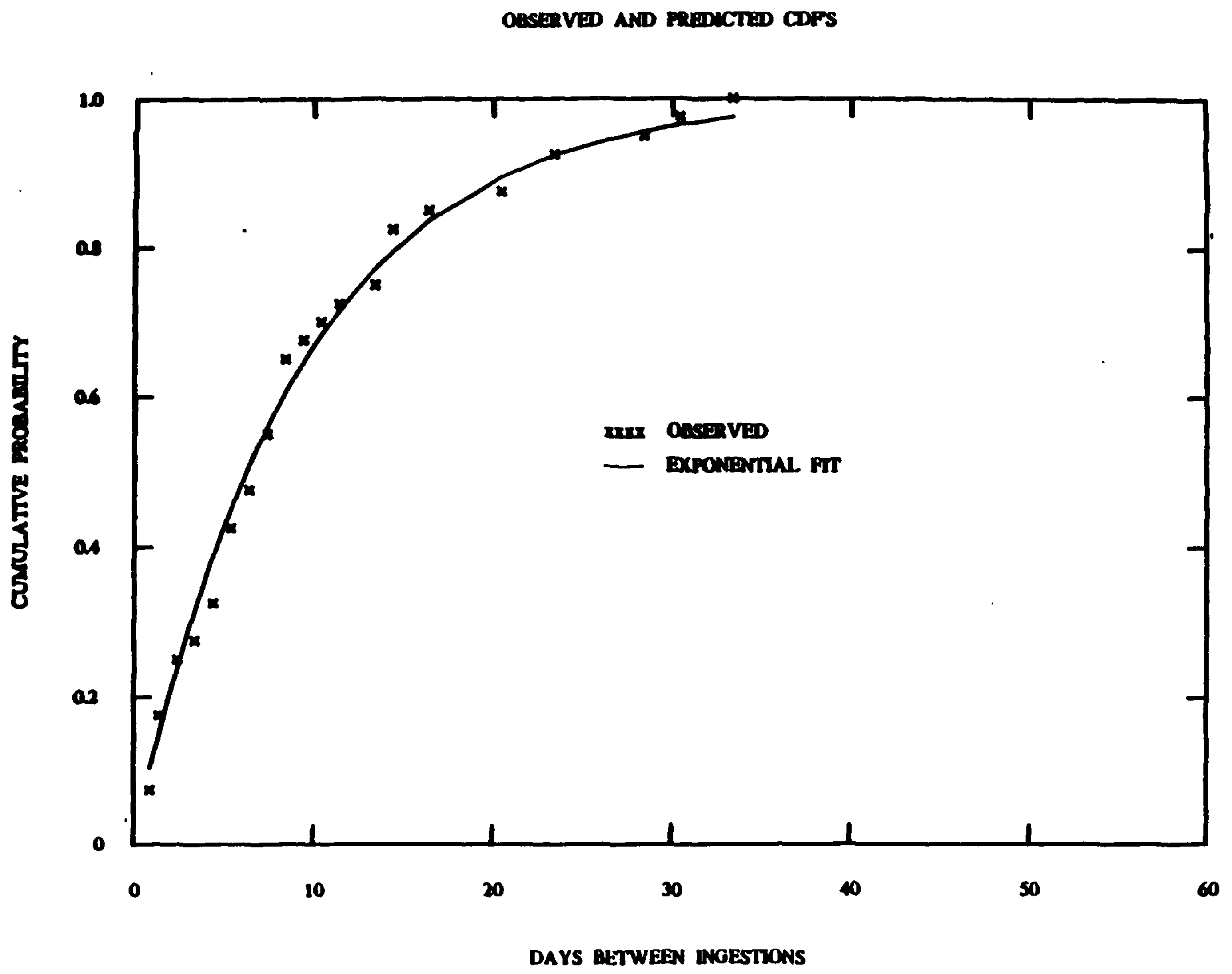


Figure 4.2 Comparison of Observed and Predicted CDFs for Domestic JT8D Aircraft Ingestion Events

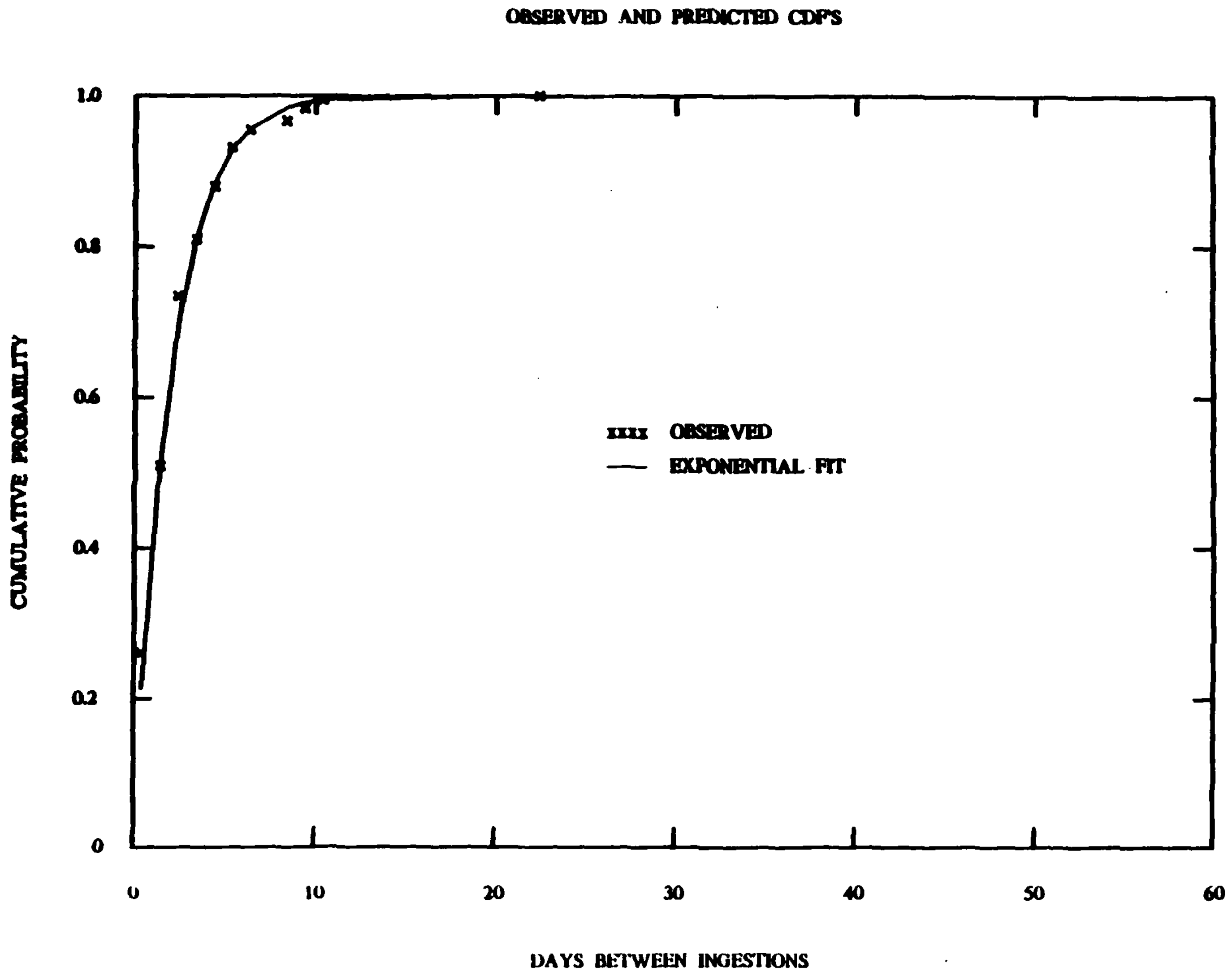


**Figure 4.3** Comparison of Observed and Predicted CDFs for Foreign JT8D Aircraft Ingestion Events

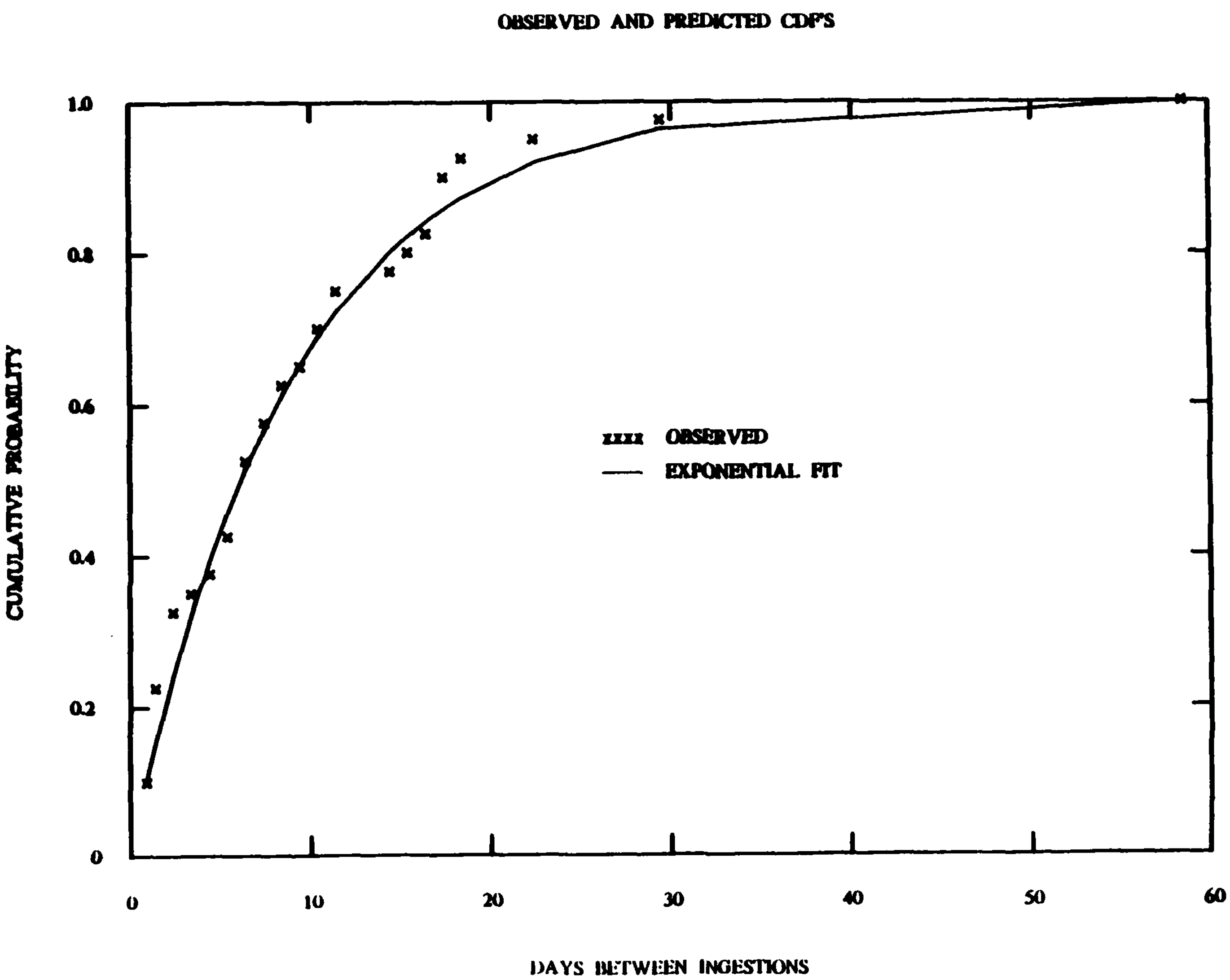


**Figure 4.4** Comparison of Observed and Predicted CDFs for Domestic CFM56 Aircraft Ingestion Events

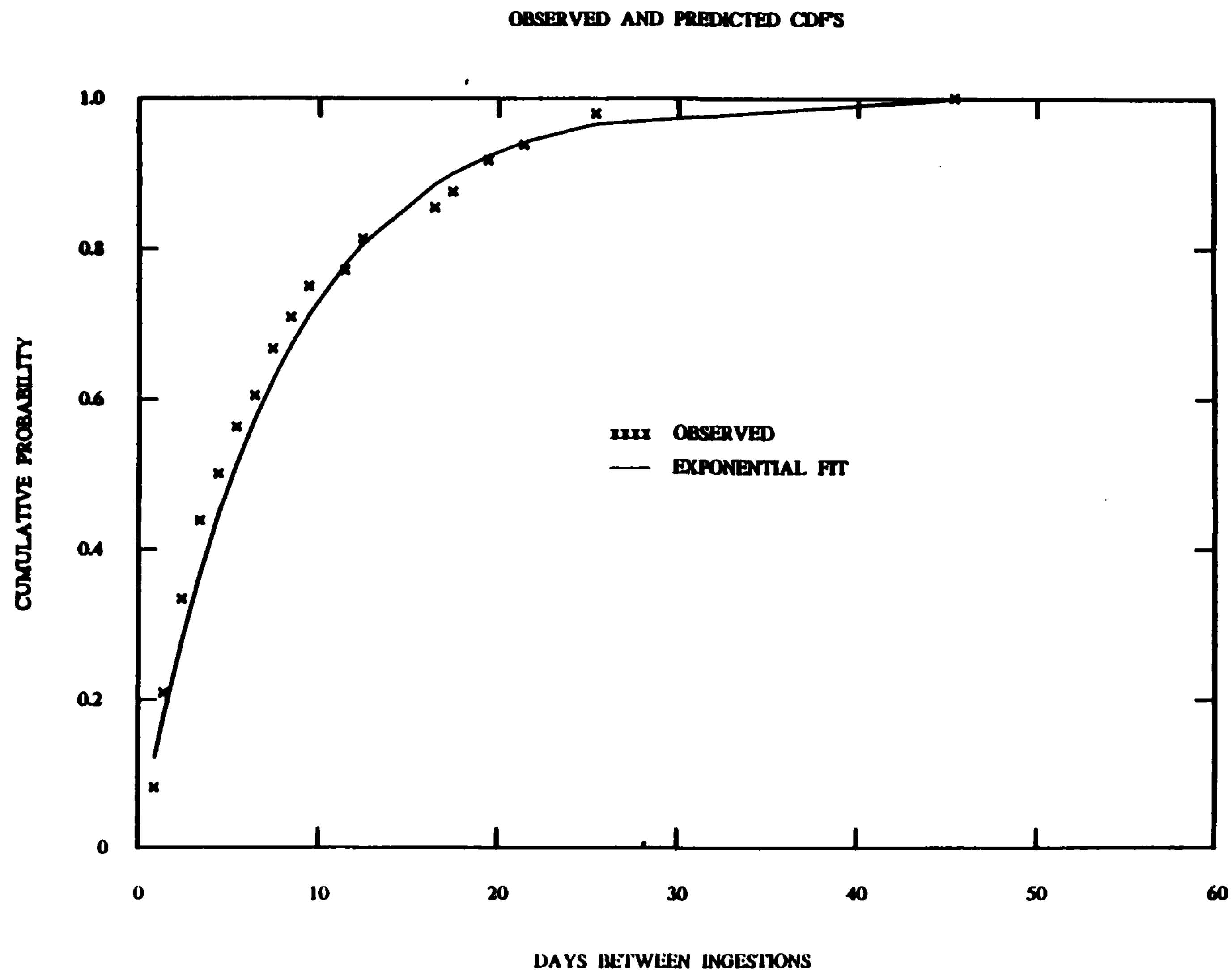


**Figure 4.5** Comparison of Observed and Predicted CDFs for Foreign CFM56 Aircraft Ingestion Events

The visual similarities are verified by the statistical tests which are summarized in table 4.3. The mean time between ingestion events is given in column one, the sample size is in column two, the critical value for a five percent significance level ($D^*$) is in column three, and the test statistic (D) is in column four. The assumption that the times between ingestion events come from an exponential distribution cannot be rejected at the five percent level in any of the four groups. The use of a Poisson process to model bird ingestions is appropriate based on these test results.

TABLE 4.3 RESULTS OF THE EXPONENTENTIAL GOF TESTS TO VERIFY THE POISSON PROCESS

| AREA | ENGINE | MEAN | SAMPLE SIZE | $D^*$ | D |
|---|---|---|---|---|---|
| United States Contiguous US | JT8D | 9.14 | 40 | 0.17 | 0.06 |
| Contiguous US | JT8D | 12.17 | 30 | 0.19 | 0.09 |
| Foreign | JT8D | 2.22 | 173 | 0.08 | 0.10 |
| United States | CFM56 | 9.00 | 40 | 0.17 | 0.08 |
| Contiguous US | CFM56 | 9.00 | 40 | 0.17 | 0.08 |
| Foreign | CFM56 | 7.64 | 48 | 0.15 | 0.07 |

## 4.4 INLET AREA EFFECT ON INGESTION RATES.

One property of the Poisson process model described in Section 4.2 is that ingestion rates should be proportional to the inlet area of the engine. The size effect can be investigated in the B737 bird ingestion data by comparing the number of ingestion events of the JT8D with the number of ingestion events of the CFM56. According to equation 4.4 the total number on ingestion events during the reporting period for a given engine has a Poisson distribution with a mean that is proportional to the number of aircraft operations in the year and to the inlet area of the engine. The number of JT8D ingestion events out of the total number of ingestion events will have a Binomial distribution if the Poisson process model is valid.

The proportion of total ingestion events that occurred in JT8D engines should be:

$$P = \frac{OJ*AJ}{OJ*AJ=OC*AC} \quad , \qquad 4.5$$

where OJ and OC are the numbers of worldwide aircraft operations for and AJ and AC are the inlet areas of the JT8D and CFM56 engines, respectively. The relevant values for Equation 4.5 can be obtained from table 4.1 giving an expected proportion of JT8D ingestion events of P = 0.67. Out of 301 total ingestion events, there were 213 JT8D ingestion events so the observed proportion of JT8D ingestion events is 0.71. The test statistic to compare the observed proportion to the predicted is the standard Z statistic for the binomial distribution given by:

$$Z = (\hat{P} - P) \;/\sqrt{(P * (1-P) \;\; /N)} \, , \qquad 4.6$$

where $\hat{P}$ is the observed proportion of JT8D engines and N is the total number of aircraft ingestion events.

The Z statistic defined in equation 4.6 is used to test the null hypothesis that there is no difference between the two types of engines in ingestion rates after adjusting for area. The test statistic is computed by substituting the value 0.67 for P and 0.71 for P in equation 4.6 to give a value of 1.36. The Z value of 1.36 is not significant at the 5 percent level of significance so there is no detectable difference in ingestion rates between the JT8D and the CFM56 after adjustment for the inlet area.

A second school of thought suggests that the relationship between engine size and ingestion rate is described better as a linear function of diameter than as a linear function of area. A similar Z test can be computed by substituting diameter for area in equation 4.5. The expected proportion of JT8D ingestion events after an adjustment for diameter is P = 0.74 and the test statistic is Z = -1.50. The null hypothesis is that there is no difference in ingestion rates after adjusting for diameter and the conclusion of the test is that there is no detectable difference at the 5 percent level of significance. There are insufficient data to determine whether area or diameter is the better measure of engine size to account for differences in ingestion rates.

## SECTION 5

## AIRPORT BIRD INGESTION EXPERIENCE

The objective of the statistics of this section is to identify the frequency and location of bird ingestion events at airports worldwide. An aircraft ingestion event is the simultaneous ingestion of one or more birds by one or more engines of an aircraft. Most of the bird ingestion data were provided by the engine manufacturer. Airport ingestion rates are expressed in terms of aircraft ingestion events per 10,000 airport operations.

The OAG tapes indicate that there are 1,032 airports worldwide for which 5,491,172 B737 airport operations were scheduled during the reporting period. Appendix A lists the airport code, airport location, and the number of scheduled airport operations at these airports. Bird ingestion events were reported at only 137 of these airports. The OAG tapes show that there were 2,306,473 scheduled airport operations at these 137 airports. There were also bird ingestion events reported by unscheduled B737 flights at five additional airports. These five airports (Gualequaychu, China, Kosti, Sudan, Milan, Italy, Surat, India, and Jerez Dela Frontera, Spain) are included in appendix A but there are no OAG operations counts for them.

A complete summary of the airports having reported aircraft ingestion events is presented in table 5.1 as a frequency count of worldwide bird ingestion events by phase of flight. The majority of aircraft ingestion events occur during takeoff or landing. This table suggests that the threat of bird ingestion is posed primarily from birds which live near the airport and/or whose migratory path crosses over or near the airport property.

Figure 5.1 is a bar chart showing reported aircraft ingestion events at domestic airports during the reporting period. There are 44 domestic airports at which bird ingestion events have been reported. The largest number of bird ingestion events reported in the United States during the period was 4 at Dallas, Love (DAL). Of the 80 bird ingestion events reported in the United States, 14 events occurred at an unknown location and they are assigned to the airport code XUS on the bar chart.

Figure 5.2 is a bar chart showing reported aircraft ingestion events at foreign airports during the reporting period. There are 98 foreign airports at which bird ingestions have been reported. The largest number of aircraft ingestion events reported abroad during the period is eight at Frankfort, Germany (FRA). Of the 221 aircraft ingestion events reported outside of the United States, 67 events occurred at an unknown location and they are assigned to the airport code XFO on the bar chart.

Table 5.2 lists all airports worldwide which experienced three or more aircraft ingestion events during the reporting period. The table also includes the number of ingestion events, the number of OAG airport operations, and the rate of aircraft ingestion events per 10,000 airport operations. The airports are listed in descending order of airport operations.

TABLE 5.1

FREQUENCY COUNT OF AIRCRAFT INGESTION EVENTS BY AIRPORT AND PHASE OF FLIGHT

| AIRPORT | AIRPORT DEFINITION | TAXI | TAKEOFF | CLIMB | CRUISE | APPROACH | LANDING | UNKNOWN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| ADL | ADELAIDE SA AUSTRALIA | | 1 | | | | | | 1 |
| AJA | AJACCIO, CORSICA, FRANCE | | | | | | 1 | | 1 |
| AKL | AUCKLAND, NEW ZEALAND | | 2 | | | | | | 2 |
| ALB | ALBANY, NY, USA | | 1 | 1 | | | | | 2 |
| ALG | ALGIERS, ALGERIA | | | | | 1 | | | 1 |
| AMS | AMSTERDAM, NETHERLANDS | | 1 | 1 | | | 1 | 1 | 4 |
| AOR | ALOR SETAR, MALAYSIA | | 1 | | | | | | 1 |
| AUS | AUSTIN, TX, USA | | | 1 | | | | | 1 |
| BBI | BHUBANESWAR, INDIA | | 1 | | | | | | 1 |
| BEG | BELGRADE, YUGOSLAVIA | | | | | | | 1 | 1 |
| BHM | BIRMINGHAM, AL, USA | | | 1 | | | 1 | | 2 |
| BHX | BIRMINGHAM, ENGLAND (UK) | | 2 | | | | | | 2 |
| BLR | BANGALORE, INDIA | | 1 | | | | 1 | 1 | 3 |
| BOM | BOMBAY, INDIA | | | | | | 1 | 1 | 2 |
| BRS | BRISTOL, ENGLAND (UK) | | | | | | 1 | | 1 |
| BRU | BRUSSELS, BELGIUM | | 1 | 1 | | | | | 2 |
| BWI | BALTIMORE, MD, USA | | 1 | | | | | | 1 |
| CCU | CALCUTTA, INDIA | | 1 | | | | 1 | | 2 |
| CDG | PARIS DE GAULLE, FRANCE | | | | | 1 | | | 1 |
| CGN | COLOGNE BONN, FRG | | 1 | | | | | | 1 |
| CHC | CHRISTCHURCH, NEW ZEALAND | | 5 | | | | 1 | 1 | 7 |
| CLE | CLEVELAND, OH, USA | | 1 | | | | | | 1 |
| CLT | CHARLOTTE, NC, USA | | 1 | | | 1 | | 1 | 3 |
| CMG | CORUMBA, MATO GROSSO, BRAZIL | | 1 | | | | | | 1 |
| CNS | CAIRNS, QLD, AUSTRALIA | | | | | | | 1 | 1 |
| CPH | COPENHAGEN, DENMARK | | 1 | | | | | | 1 |
| CPT | CAPE TOWN, SOUTH AFRICA | | 1 | | | | | | 1 |
| CTU | CHENGDU, P.R. CHINA | 1 | | | | | | | 1 |
| DAB | DAYTONA BEACH, FL, USA | | 1 | | | | | | 1 |
| DAL | LOVE DALLS/FT. WORTH, TX, USA | | | | | 2 | | 2 | 4 |
| DAY | DAYTON, OH, USA | | | 1 | | | | | 1 |
| DEN | STAPLETON INT'L, DENVER, CO, USA | | 1 | | | 1 | | | 2 |
| DFW | DALLAS/FT WORTH, TX, USA | | 1 | | | | | | 1 |
| DUB | DUBLIN, REPUBLIC OF IRELAND | | | | | 1 | | | 1 |
| DUR | DURBAN, SOUTH AFRICA | | 2 | | | | | | 2 |
| DUS | DUESSELDORF, FRG | | 1 | | | | 1 | | 2 |
| ELS | EAST LONDON, SOUTH AFRICA | | 2 | | | | 1 | | 3 |
| EWR | NEWARK, NEW YORK, NY, USA | | 1 | | | | | | 1 |
| EZE | BUENOS AIRES-EZEIZA ARPT, ARGENTINA | | 1 | | | | | | 1 |
| FAT | FRESNO, CA, USA | | 1 | | | | | | 1 |

TABLE 5.1 (continued)

FREQUENCY COUNT OF AIRCRAFT INGESTION EVENTS BY AIRPORT AND PHASE OF FLIGHT

| AIRPORT | AIRPORT DEFINITION | TAXI | TAKEOFF | CLIMB | CRUISE | APPROACH | LANDING | UNKNOWN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| FLL | FT LAUDERDALE, FL, USA | | 1 | | | | | | 1 |
| FNC | FUNCHAL - MADEIRA, PORTUGAL | | 1 | | | | | | 1 |
| FRA | FRANKFURT, FRG | 1 | 3 | 1 | | 1 | | 2 | 8 |
| GAU | GAUHATI, INDIA | | 1 | | | | | | 1 |
| GHU | GUALEGUAYCHU, ARGENTINA | | 1 | | | | | | 1 |
| GOA | GENOA, ITALY | | 1 | | | | | | 1 |
| GRZ | GRAZ, AUSTRIA | | | | | | 1 | | 1 |
| HAC | HACHIJO, JIMA ISLAND, JAPAN | | | | | | 1 | | 1 |
| HAM | HAMBURG, FRG | | 2 | | | | | | 2 |
| HOU | HOUSTON, TX, USA | | 1 | | | | 2 | | 3 |
| HRL | HARLINGEN, TX, USA | | | | | | 1 | | 1 |
| HYD | HYDERABAD, INDIA | | 1 | | | | | | 1 |
| IAD | DULLES INT'L, WASHINGTON, DC, USA | | | | | | | 1 | 1 |
| IBZ | IBIZA, SPAIN | | | | | | 1 | | 1 |
| ISG | ISHIGAKI, JAPAN | | 1 | | | | | | 1 |
| ITO | HILO HAWAII, HA, US | | 1 | | | | | | 1 |
| IXB | BAGDOGRA, INDIA | | | | | | | 1 | 1 |
| JAI | JAIPUR, INDIA | | | | | | 1 | 1 | 2 |
| JNB | JOHANNESBURG, SOUTH AFRICA | | 2 | | | | | | 2 |
| JRH | JORHAT, INDIA | | | | | | | 1 | 1 |
| KCH | KUCHING, SARAWAK, MALAYSIA | | | 1 | | | | | 1 |
| KGS | KOS, GREECE | | 1 | | | | | | 1 |
| KHH | KAOHSIUNG, TAIWAN | | | | | | 1 | 1 | 2 |
| KHI | KARACHI, PAKISTAN | | | | | | 1 | 1 | 2 |
| KMG | KUNMING, P.R. CHINA | | 1 | | | | | | 1 |
| KST | KOSTI, SUDAN | | | | | 1 | | | 1 |
| KUL | KUALA LUMPUR, MALAYSIA | | | | | 1 | 1 | | 2 |
| LCA | LARNACA, CYPRUS | | | | | | 1 | | 1 |
| LEX | LEXINGTON, KY, USA | | 1 | | | | | | 1 |
| LGA | NEW YORK LA GUARDIA, NY, USA | | 1 | | | | | | 1 |
| LHE | LAHORE, PAKISTAN | | | | | | | 1 | 1 |
| LHR | LONDON HEATHROW, ENGLAND, (UK) | | | | | 2 | | | 2 |
| LIH | LIHUE, KAUAI, HA, US | | 2 | | | | | | 2 |
| LIN | MILAN LINATE, ITALY | | 1 | | | | | | 1 |
| LIT | LITTLE ROCK, AK, USA | | 1 | | | | | | 1 |
| LLW | LILONGWE, MALAWI | | 1 | | | | | | 1 |
| LNZ | LONZ, AUSTRIA | | 1 | | | | | | 1 |
| LOS | LAGOS, NIGERIA | | 1 | | | | | | 1 |
| LST | LAUNCESTON, TASMANIA, AUSTRALIA | | | | | | 1 | | 1 |
| MAD | MADRID, SPAIN | | 1 | | | | | | 1 |

TABLE 5.1 (continued)

FREQUENCY COUNT OF AIRCRAFT INGESTION EVENTS BY AIRPORT AND PHASE OF FLIGHT

| AIRPORT | AIRPORT DEFINITION | TAXI | TAKEOFF | CLIMB | CRUISE | APPROACH | LANDING | UNKNOWN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| MAF | MIDLAND ODESSA, TX, USA | | 1 | | | | | | 1 |
| MAN | MANCHESTER, ENGLAND (UK) | | 3 | | | | | | 3 |
| MCO | ORLANDO-INT'L, FL, USA | | | | | | 1 | | 1 |
| MDT | HARRISBURG-OLMSTEAD ST, PA, USA | | 1 | | | | | | 1 |
| MDW | CHICAGO-MIDWAY, IL, USA | | 1 | | | | | | 1 |
| MEL | MELBOURNE, VICTORIA, AUSTRALIA | | | | | | 1 | | 1 |
| MIL | MILAN, ITALY | | 1 | | | | | | 1 |
| MMY | MIYAKO JIMA, JAPAN | | 3 | | | | 2 | | 5 |
| MSO | MISSOULA, MT, USA | | | | | | 1 | | 1 |
| MSP | MINNEAPOLIS-ST PAUL, MN, USA | | 1 | | | | | | 1 |
| MUC | MUNICH, FRG | | 2 | | | 1 | 1 | | 4 |
| NCE | NICE, FRANCE | | | | | | 1 | | 1 |
| NUE | NUREMBURG, FRG | | | 1 | | | | | 1 |
| OAK | OAKLAND, SAN FRANCISCO, CA, USA | | 1 | | | | 2 | | 3 |
| OGG | KAHULUI, MAUI, HA, US | | 2 | | | | | | 2 |
| OPO | OPORTO, PORTUGAL | | 1 | | | | | | 1 |
| ORD | CHICAGO-O'HARE, IL, USA | | 1 | 1 | | | | | 2 |
| ORF | NORFOLK-VA. BEACH, VA, USA | | 1 | | | | 1 | | 2 |
| ORY | PARIS - ORLY ARPT, FRANCE | | 1 | | | | | | 1 |
| PAT | PATNA, INDIA | | | | | | | 1 | 1 |
| PDX | PORTLAND, OR, USA | | | 1 | | | 2 | | 3 |
| PEK | BEIJIN, P. R. CHINA | 1 | | | | | 1 | | 2 |
| PEN | PENANG, MALAYSIA | | 1 | 1 | | | | | 2 |
| PIE | TAMPA-ST. PETERSBURG, FL, USA | | 3 | | | | | | 3 |
| PLZ | PORT ELIZABETH, SOUTH AFRICA | | 1 | | | | | | 1 |
| PMR | PALMERSTON, NEW ZEALAND | | 1 | | | | 1 | | 2 |
| RAP | RAPID CITY, SD, USA | | 1 | | | | | | 1 |
| RNO | RENO, NV, USA | | | 1 | | | | | 1 |
| SAT | SAN ANTONIO, TX, USA | | 1 | | | | | 1 | 2 |
| SCC | PRUDHOE BAY, DEADHORSE, AS, US | | | | | | 1 | | 1 |
| SDF | LOUISVILLE, KY, USA | | 1 | | | | | | 1 |
| SFO | SAN FRANCISCO-OAKLAND, CA, USA | | | 2 | | | | | 2 |
| SJC | SAN JOSE, CA, USA | | 2 | | | | | | 2 |
| SLC | SALT LAKE CITY, UT, USA | | | | 1 | | | | 1 |
| SNA | ORANGE COUNTY, CA, USA | | 1 | | | | | | 1 |
| STR | STUTTGART, FRG | | | | | | 1 | | 1 |
| STV | SURAT, INDIA | | 1 | | | | | | 1 |
| SXR | SRINAGAR, INDIA | | | | | | 1 | | 1 |
| SYD | SYDNEY, N.S.W., AUSTRALIA | | | 1 | | 1 | | | 2 |
| TFS | TENERIFFE-REINASOFIA, CANARY ISLAND | | | 1 | | | | | 1 |

TABLE 5.1 (concluded)

FREQUENCY COUNT OF AIRCRAFT INGESTION EVENTS BY AIRPORT AND PHASE OF FLIGHT

| AIRPORT | AIRPORT DEFINITION | TAXI | TAKEOFF | CLIMB | CRUISE | APPROACH | LANDING | UNKNOWN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| TGD | TITOGRAD, YUGOSLAVIA | | | | | | 1 | | 1 |
| TLV | TEL AVIV-YAFO, ISRAEL | | 1 | | | | | | 1 |
| TNG | TANGIER, MOROCCO | | 1 | | | | 1 | 1 | 3 |
| TRV | TRIVANDRUM, INDIA | | | | | | 2 | 1 | 3 |
| TSV | TOWNSVILLE, QLD, AUSTRALIA | | | | | | 1 | | 1 |
| TUN | TUNIS, TUNISIA | | | | | | 1 | | 1 |
| TVL | LAKE TAHOE, CA, USA | | | 1 | | | | | 1 |
| TXL | WEST BERLIN, GERMANY | | 1 | | | | | | 1 |
| UET | QUETTA, PAKISTAN | | | | | | | 1 | 1 |
| VDM | VIEDMA, ARGENTINA | | | | | | | 1 | 1 |
| VNS | VARANASI, INDIA | | 1 | | | | | 2 | 3 |
| WDH | WINDHOEK, NAMIBIA | | | | | | 1 | | 1 |
| WLG | WELLINGTON, NEW ZEALAND | | 2 | | | | | | 2 |
| XRY | JEREZ DE LA FRONTERA, SPAIN | | | | | 1 | | | 1 |
| YAM | SAULT STE MARIE, ONT., CANADA | | 1 | | | | | | 1 |
| YUL | MONTREAL, QUEBEC, CANADA | | 1 | | | | | | 1 |
| YXD | EDMONTON-MUNICIPAL, ALBERTA, CANADA | | | | | | 1 | | 1 |
| YXS | PRINCE GEORGE, BC, CANADA | | | | | | 1 | | 1 |
| YYC | CALGARY, ALBERTA, CANADA | | | | | | 1 | | 1 |
| YYZ | TORONTO, ONTARIO, CANADA | | 1 | | | | | | 1 |
| ZRH | ZURICH, SWITZERLAND | | 1 | | | | 2 | | 3 |
| ZTH | ZAKINTHOS, GREECE | | | | | 1 | | | 1 |
| -0- | AIRPORT UNKNOWN | | 9 | | | 1 | 3 | 68 | 81 |
| | AIRPORTS WITH KNOWN INGESTIONS | 3 | 115 | 18 | 1 | 17 | 54 | 94 | 382 |

BOEING-737 BIRD INGESTION STUDY

AIRCRAFT INGESTIONS AT DOMESTIC AIRPORTS
( OCTOBER 1986 - SEPTEMBER 1987 )

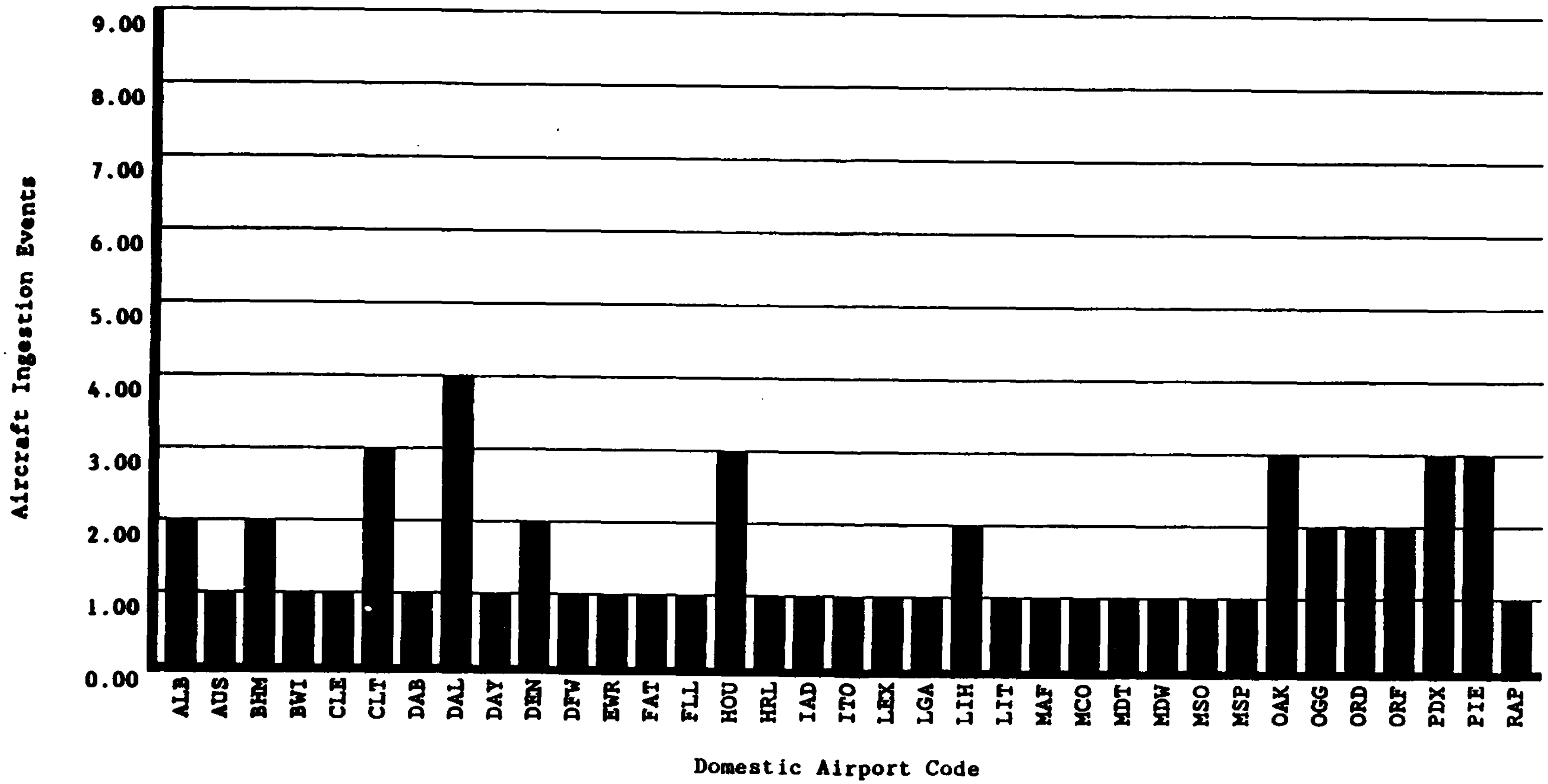


Figure 5.1 Histogram of Aircraft Ingestion Events at Domestic Airports

BOEING-737 BIRD INGESTION STUDY

AIRCRAFT INGESTIONS AT DOMESTIC AIRPORTS
( OCTOBER 1986 - SEPTEMBER 1987 )

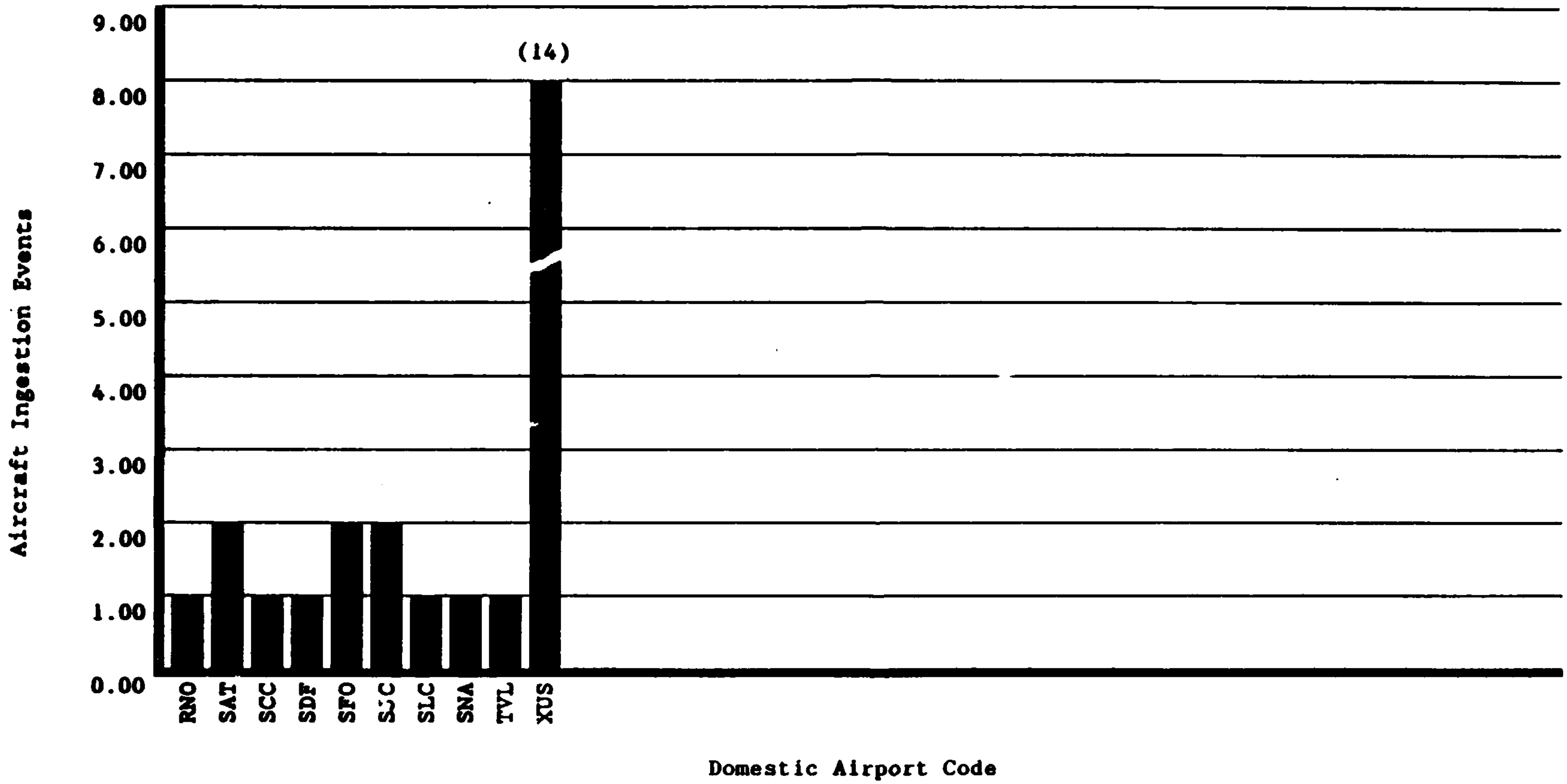


Figure 5.1 Histogram of Aircraft Ingestion Events at Domestic Airports (concluded)

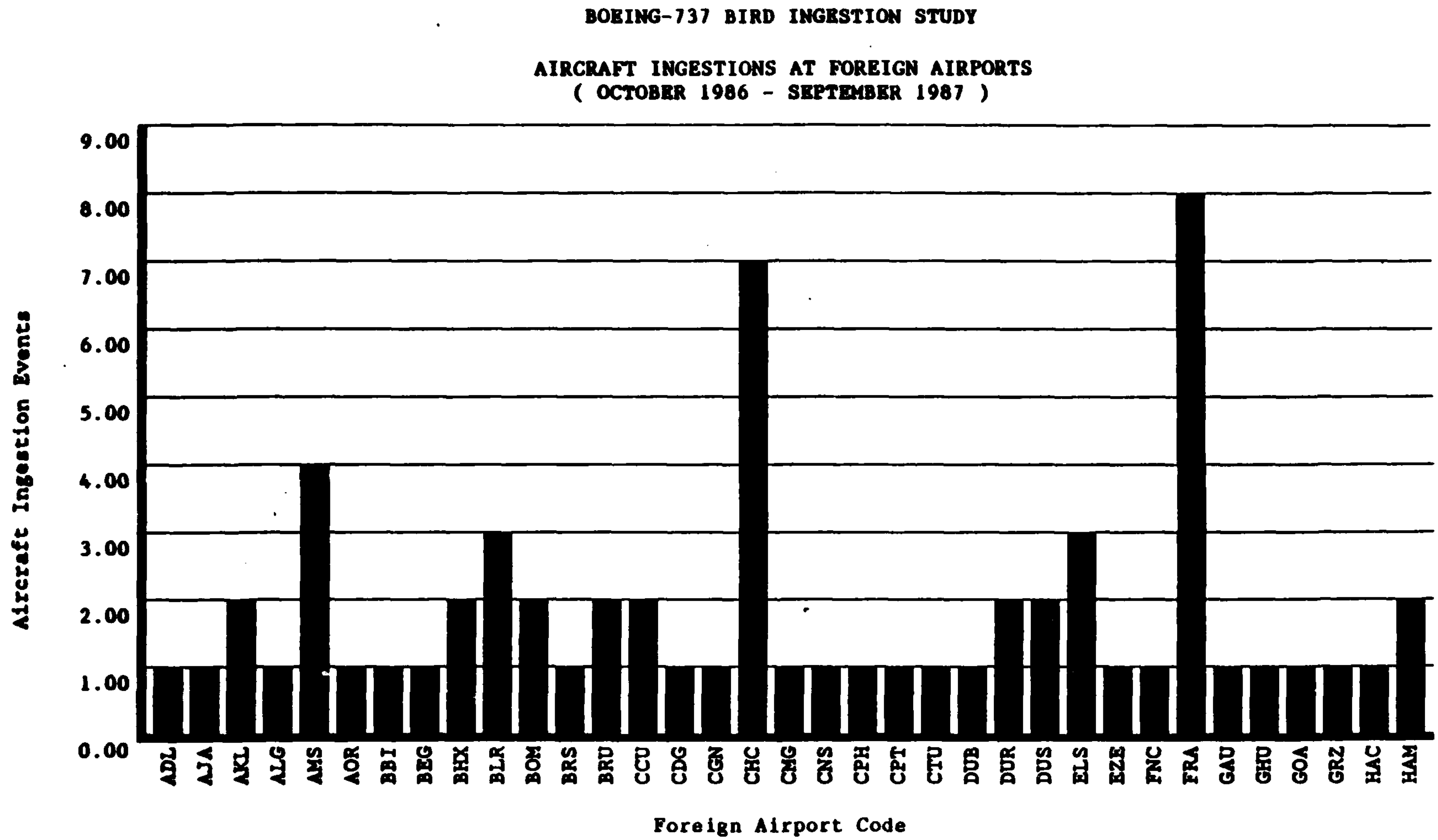


Figure 5.2 Histogram of Aircraft Ingestion Events at Foreign Airports

BOEING-737 BIRD INGESTION STUDY

AIRCRAFT INGESTIONS AT FOREIGN AIRPORTS
( OCTOBER 1986 - SEPTEMBER 1987 )

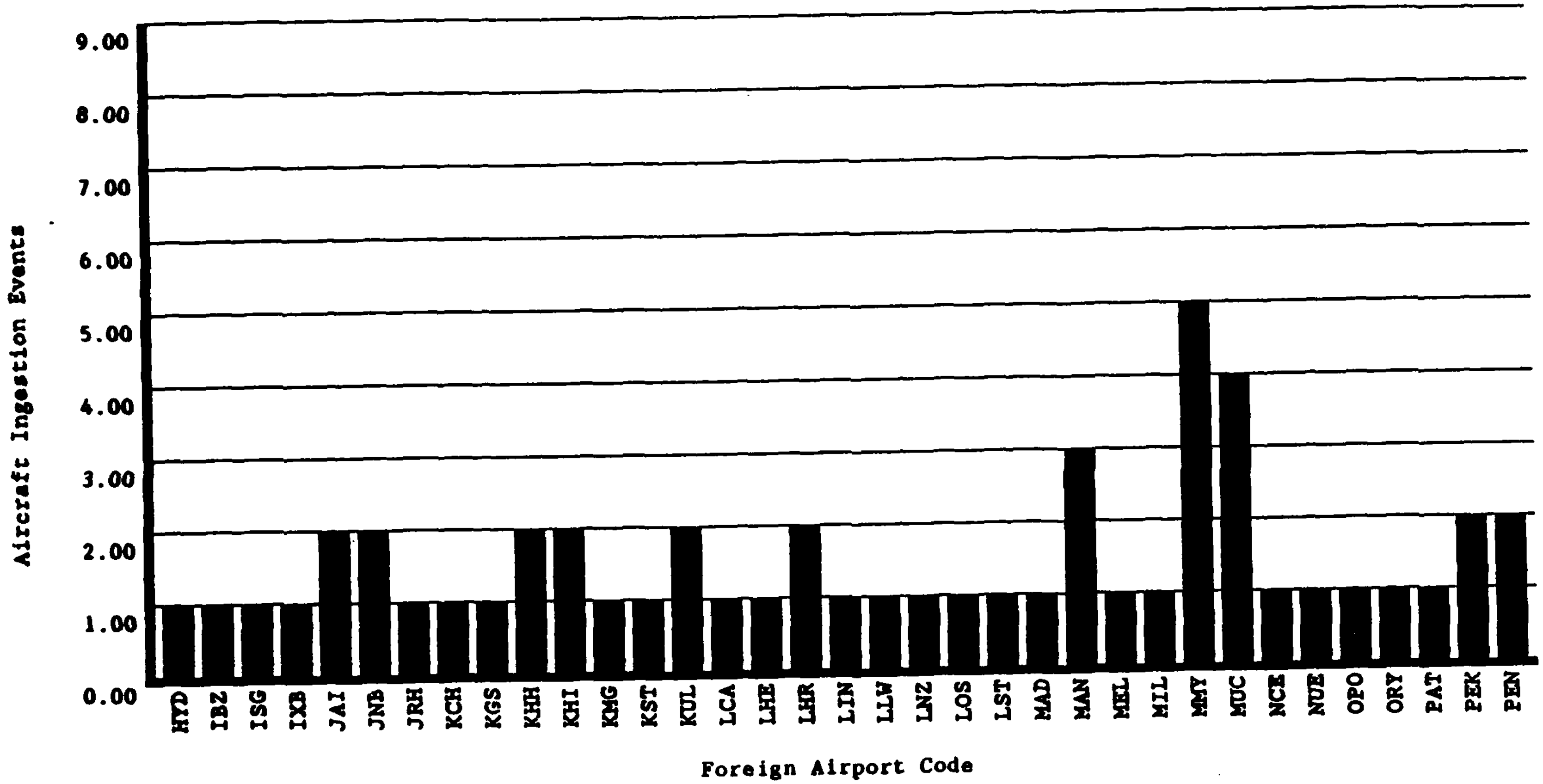


Figure 5.2 Histogram of Aircraft Ingestion Events at Foreign Airports (continued)

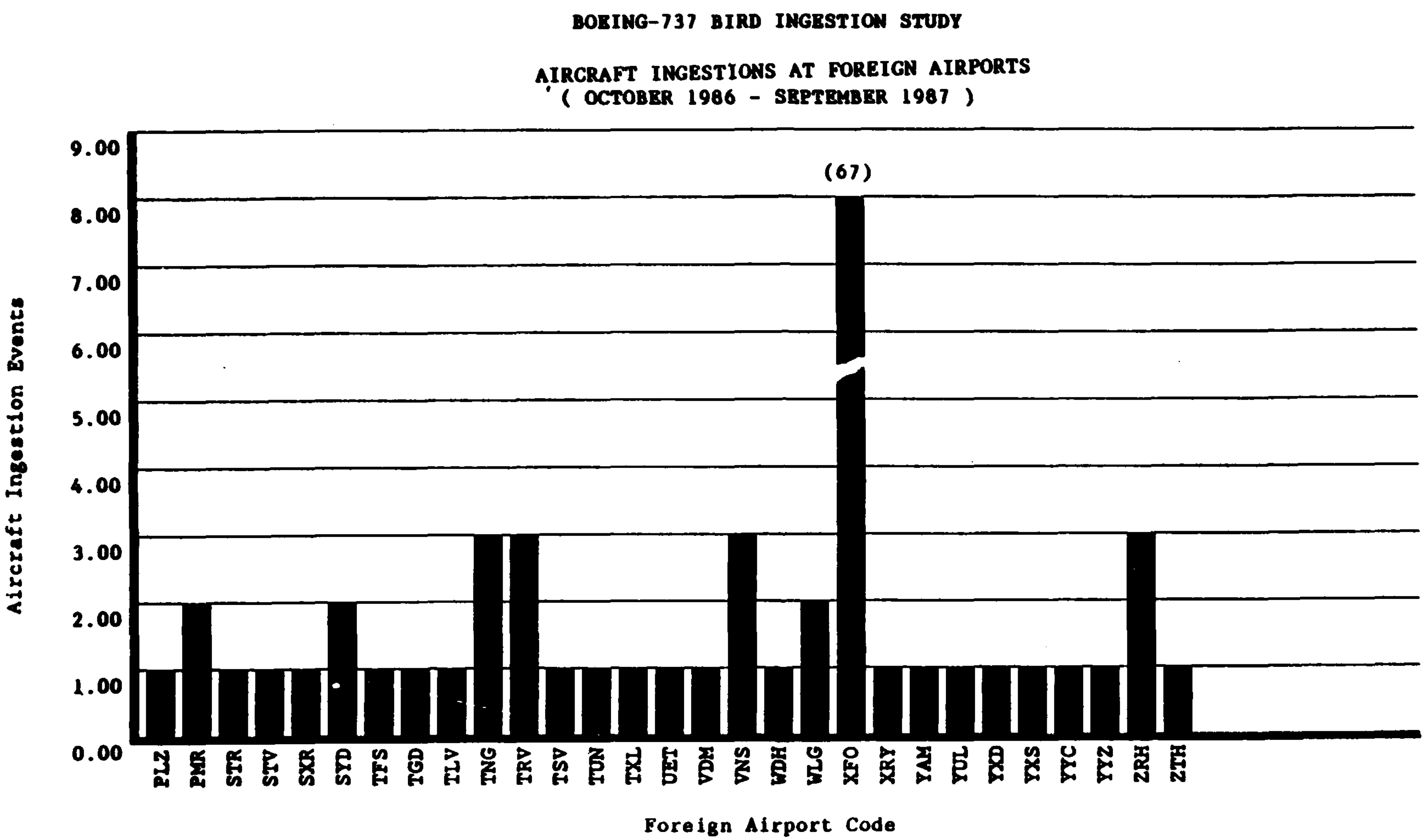


Figure 5.2 Histogram of Aircraft Ingestion Events at Foreign Airports (concluded)

TABLE 5.2 AIRPORT BIRD INGESTION RATES

(3 Or More Ingestions)

| Airport Code | Airport Operations | Aircraft Ingestion Events | Ingestion Rate Events/10K Ops | Airport Location |
|---|---|---|---|---|
| CLT | 95251 | 4 | 0.84 | CHARLOTTE, NC, USA |
| DAL | 75124 | 5 | 1.33 | LOVE DALLAS/FT. WORTH, TX, USA |
| HOU | 71429 | 4 | 1.12 | HOUSTON, TX, USA |
| ORD | 59542 | 3 | 1.01 | CHICAGO-O'HARE, IL, USA |
| FRA | 52274 | 8 | 3.06 | FRANKFURT, FRG |
| MUC | 36435 | 4 | 2.20 | MUNICH, FRG |
| OAK | 27453 | 3 | 2.19 | OAKLAND, SAN FRANCISCO, CA, USA |
| AMS | 19047 | 4 | 4.20 | AMSTERDAM, NETHERLANDS |
| PDX | 18968 | 3 | 3.16 | PORTLAND, OR, USA |
| CHC | 17095 | 7 | 8.19 | CHRISTCHURCH, NEW ZEALAND |
| ZRH | 12226 | 3 | 4.91 | ZURICH, SWITZERLAND |
| ELS | 9987 | 3 | 6.01 | EAST LONDON, SOUTH AFRICA |
| BLR | 5886 | 3 | 10.19 | BANGALORE, INDIA |
| MAN | 5780 | 3 | 10.38 | MANCHESTER, ENGLAND (UK) |
| MMY | 3606 | 5 | 27.73 | MIYAKO JIMA, JAPAN |
| VNS | 3150 | 3 | 19.05 | VARANASI, INDIA |
| TRV | 2374 | 3 | 25.27 | TRIVANDRUM, INDIA |
| TNG | 2117 | 3 | 28.34 | TANGIER, MOROCCO |
| PIE | 302 | 3 | 198.68 | TAMPA-ST. PETERSBURG, FL, USA |
| | 518046 | 74 | 2.86 | |

The rates of bird ingestion events per aircraft operation as summarized previously in table 4.1 are twice the rates of bird ingestion events per airport operation. The number of reported foreign bird ingestion events exceeds the number of reported domestic ingestion events by a factor of 2.7; however, the number of foreign airport operations is less than the number of domestic airport operations. The rate of reported bird ingestions per airport operation is 3.4 times higher at foreign airports than at domestic airports. This implies that either (1) there are far less birds in the environment of domestic airports, possibly due to environmental control programs, or (2) foreign airline operators are much more conscientious and cooperative in reporting bird ingestions.

## SECTION 6

## ENGINE DAMAGE DESCRIPTION

The type of damage incurred by well-defined bird ingestions is useful in refining bird certification test criteria that could lead to improved engine design. In general, three parameters are used to describe engine damage and failure. The first is the type of damage incurred, the second is whether or not the engine failed, and the third is a description of the crew action taken during the ingestion event. The first part of this section provides descriptions of the types of damage incurred during the study and the types of crew actions implemented as a result of the bird ingestion. The second part describes the statistical analysis of the relationship between bird weight and the likelihood of damage occurring in an ingestion. (The information about engine failures was not available at the time of this report so engine failures are not discussed here.)

### 6.1 ENGINE DAMAGE AND CREW ACTION DESCRIPTIONS.

The types of damage that were identified in the data base were grouped into 14 categories which are defined in table 6.1. Within the first year of data collection only 11 of the categories occurred. Tabulations of the occurrences of combinations of damage categories are presented in table 6.2. The triangular top portion of the table provides tallies of co-occurrences for all pairs of damage categories. The number in the top portion represents the number of engine ingestion events in which both the row damage and the column damage occurred. The events in which more than two types of damage occurred were also included in the tallies of the top portion of table 6.2. There were six events in which three types of damage occurred and one event with five types of damage.

There are insufficient data in the top portion of table 6.2 to make any strong statements about correlations between types of damage. There is some indication that bent and dented blades accompany broken and shingled blades and that leading edge damage is connected to shingling; however, these trends cannot be strongly substantiated because of the small amount of data. The observed trends could provide the starting point for further investigations into the damage mechanisms of bird ingestions.

The bottom half of table 6.2 provides tallies of the number of events in which each damage category was the only type of damage and the total number of events that involved each of the damage categories. Fewer than three bent and dented blades, shingled blades, and broken blades seem more likely to occur by themselves than other types of damage. When more than three blades are bent or dented there is a much higher chance that some other type of damage will also occur. As with the trends identified in the top portion of table 6.2, there is insufficient evidence to strongly substantiate these trends.

There were four types of crew action identified in connection with the aircraft ingestion events in the data base. An air turnback was performed in 36 of the events, the takeoff was aborted 19 times, a diversionary maneuver was performed four times and in one event the crew action was listed as other without specifying the type of action taken. There was no unusual crew action taken in 57 of the aircraft ingestion events for which a crew action entry was recorded,

TABLE 6.1 DEFINITION OF ENGINE DAMAGE CATEGORIES

| DAMAGE CATEGORY | SEVERITY LEVEL | DAMAGE DEFINITION |
|---|---|---|
| TRVSFRAC | Severe | Transverse fracture - a fan blade broken or torn and/or a piece missing (includes secondary hard object damage). |
| CORE | Severe | Bent/broken compressor blades/vanes, blade/vane clash, blocked/disrupted airflow in low, intermediate, and high pressure compressors. |
| FLANGE | Severe | Flange separations. |
| TURBINE | Severe | Turbine damage. |
| BE/DE>3 | Moderate | More than three fan blades bent or dented. |
| TORN>3 | Moderate | More than three torn fan blades. |
| BROKEN | Moderate | Broken fan blades, leading edge and/or tip pieces missing, other blades also dented. |
| SPINNER | Moderate | Dented, broken, or cracked spinner (includes spinner cap). |
| RELEASED | Moderate | Released (walked) fan blades. |
| TORN<3 | Mild | Three or fewer torn fan blades. |
| SHINGLED | Mild | Shingled (twisted) fan blades. |
| NACELLE | Mild | Dents and/or punctures to the engine enclosure (includes cowl). |
| LEAD_EDG | Mild | Leading edge distortion/curl. |
| BEN/DEN | Mild | One to three fan blades bent or dented. |

## TABLE 6.2 TYPES OF DAMAGE CAUSED BY BIRD INGESTIONS

| | LEAD_EDG | BEN/DEN | BE/DE>3 | TORN<3 | TORN>3 | BROKEN | SHINGLED | TRVSFRAC | CORE | RELEASED |
|---|---|---|---|---|---|---|---|---|---|---|
| BEN/DEN | 1 | | | | | | | | | |
| BE/DE>3 | 1 | 0 | | | | | | | | |
| TORN<3 | 1 | 1 | 1 | | | | | | | |
| TORN>3 | 0 | 0 | 1 | 0 | | | | | | |
| BROKEN | 1 | 5 | 3 | 1 | 1 | | | | | |
| SHINGLED | 6 | 6 | 5 | 0 | 0 | 2 | | | | |
| TRVSFRAC | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | | |
| CORE | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | | |
| RELEASED | 0 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | |
| TURBINE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LEAD_EDG | BEN/DEN | BE/DE>3 | TORN<3 | TORN>3 | BROKEN | SHINGLED | TRVSFRAC | CORE | RELEASED | TURBINE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ONLY DAMAGE | 5 | 35 | 4 | 0 | 0 | 13 | 26 | 1 | 3 | 0 | 1 |
| TOTAL | 14 | 49 | 13 | 3 | 1 | 22 | 43 | 4 | 4 | 3 | 1 |

which is about half the time. The crew action should correspond to the phase of flight in which the event occurred. No change in the flight is usually required when an ingestion occurs during a landing maneuver. The air turnbacks and aborted takeoffs would most likely occur during takeoff and climb phases since there were practically no ingestions during the cruise phase.

## 6.2 PROBABILITY OF DAMAGE.

One of the key questions that inspired the bird ingestion survey is the issue of what size bird should be simulated in certification testing. Two of the main issues in deciding what the certification bird size should be are (1) the likelihood of ingesting a bird of the certification size or larger and (2) the likelihood that damage will result from ingesting a bird of the certification size. The issue of bird sizes is discussed in Sections 3 and 7 while the probability of damage is the topic of this section.

The problem of relating bird weight to the probability of damage (POD) is similar to bio-assay experiments which try to predict the probability of a response as a function of dose size. The key elements of similarity are that the probability of success for a dichotomous (pass/fail) trial is related to a continuous stimulus variable. In bird ingestions the dichotomous trial is whether or not damage occurs and the stimulus variable is the weight of the ingested bird.

Linear logistic analysis is the most commonly used method of analyzing the dosage-response type of data and has been used successfully in relating the probability of transparencies breaking as a function of projectile size in dealing with the problem of propwash blown gravel breaking helicopter windshields (5). The logistic distribution function is assumed to describe the relationship between the probability of damage and the bird weight in a linear logistic analysis. The logistic distribution function is given by:

$$POD(w) = 1/\left\{1+\exp\left[-(\pi/\sqrt{3})(w-\mu)/\sigma\right]\right\} \qquad 6.1$$

where w is the bird weight, $\mu$ is the weight with a 50 percent chance of causing damage and $\sigma$ is a parameter that is related to the steepness of the POD function.

The estimation of the function given in equation 6.1 has been extensively studied and the methods have been described in the literature (6,7). The method of maximum likelihood provides the best estimates for the type of data in the bird ingestion study since there are only a few ingestions at each weight. The software for estimating the parameters of equation 6.1 has been developed and extensively tested at the UDRI (8) and verified by researchers at other institutions.

The types of damage were categorized as mild, moderate or severe by the FAA. Table 6.3 itemizes the types of damage that were included in each of the severity categories. Three distinct analyses were conducted based on the severity ratings. The three analyses estimated the probability of any damage, the probability of at least moderate damage, and the probability of severe damage as a function of bias weight. Figures 6.1, 6.2, 6.3 show the estimated POD functions along with confidence bounds on the POD functions for the three analyses.

TABLE 6.3 DAMAGE SEVERITY DEFINITIONS

| SEVERITY LEVEL | DAMAGE DEFINITION |
|---|---|
| SEVERE DAMAGE | Damage classified as most severe. Achieved when reported damage category is TRVSFRAC, CORE, FLANGE, or TURBINE. |
| MODERATE DAMAGE | Damage classified as moderately severe. Achieved when reported damage category is BE/DE>3, TORN>3, BROKEN, SPINNER, or RELEASED and no SEVERE damage has been reported. |
| MILD DAMAGE | Damage classified as mildly severe. Achieved when reported damage category is LEAD_EDG, BEN/DEN, TORN<3, SHINGLED, or NACELLE and no SEVERE nor MODERATE damage has been reported. |

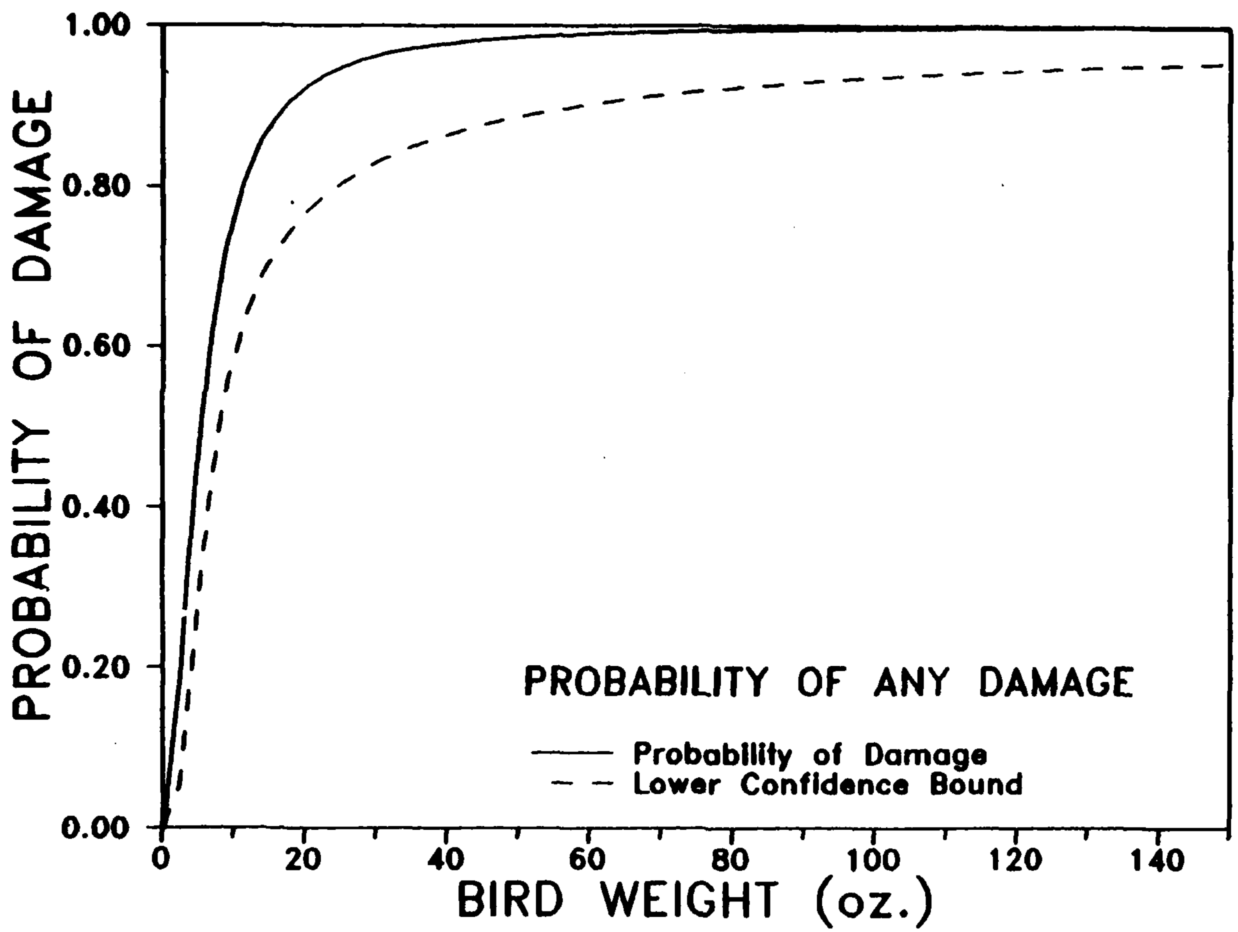


Figure 6.1 Estimated POD Function for Any Damage with the 95 Percent Confidence Bound.

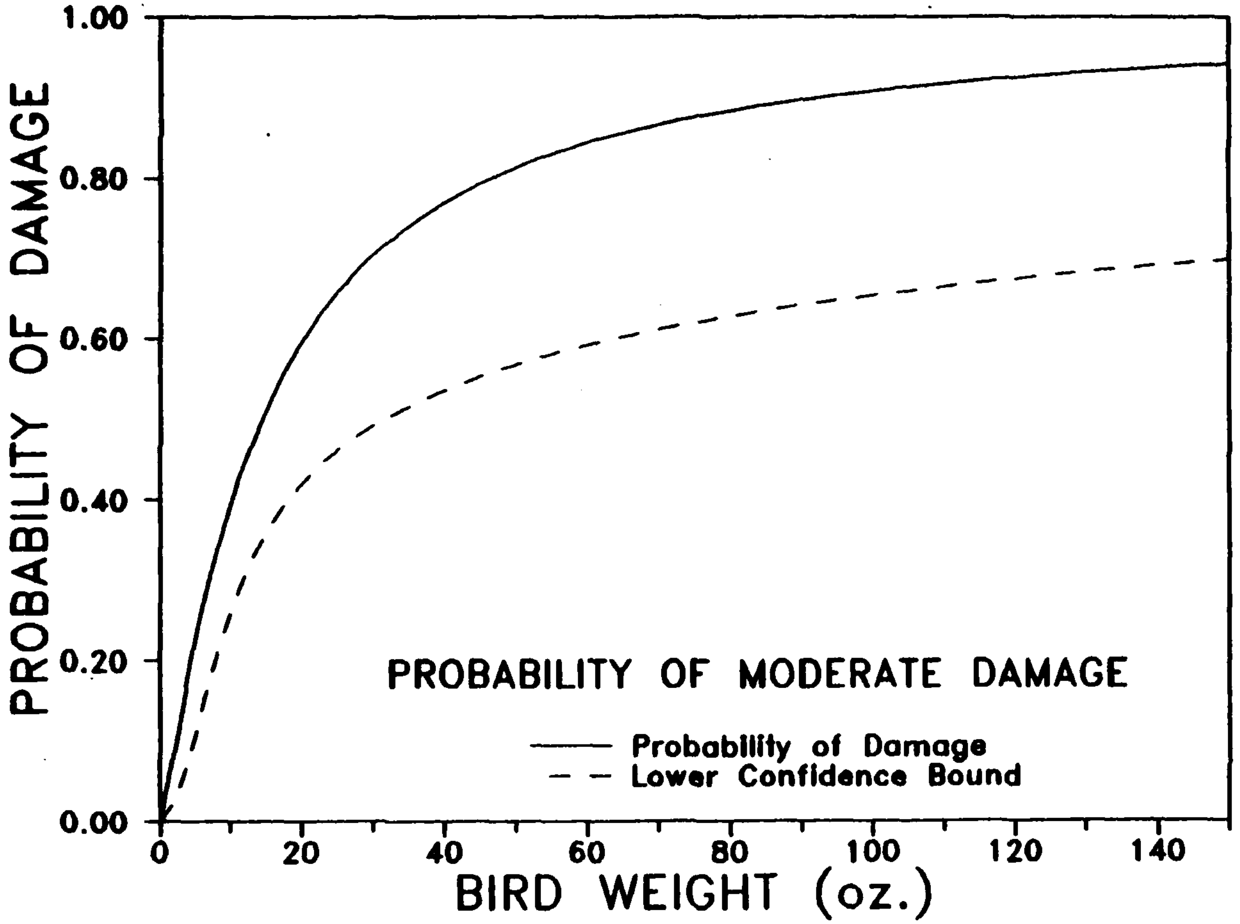


Figure 6.2 Estimated POD Function for Moderate or Worse Damage with the 95 Percent Confidence Bound.

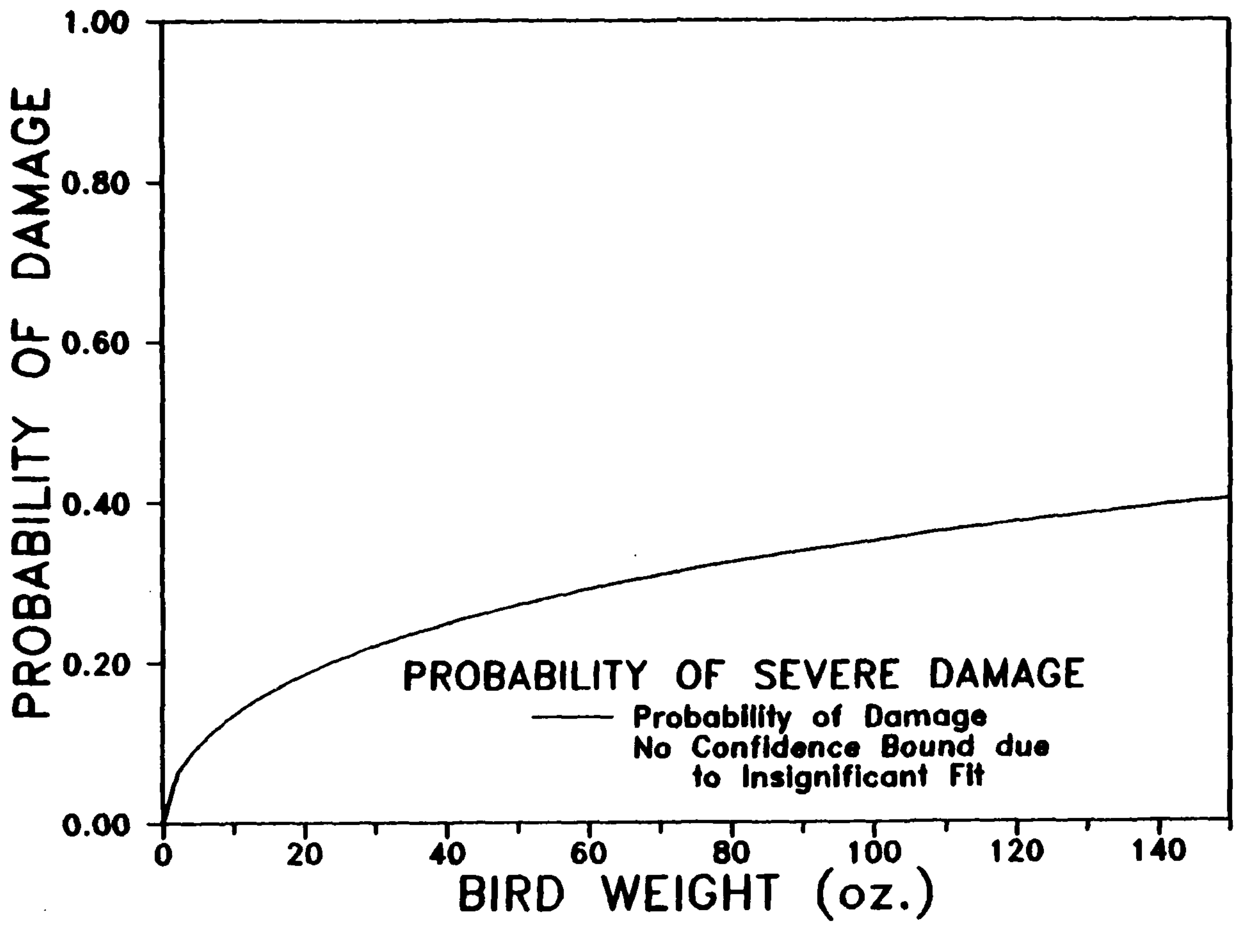


Figure 6.3 Estimated POD Function for Severe Damage.

Figure 6.1 shows the probability of any damage occurring and includes all three severity levels as positive responses. The probability of any damage occurring rises very steeply, reaching 50 percent at about 5 ounces and the curve levels off at the 95 percent level at about 30 ounces. The relationship between bird weight and the probability of any damage is very strong and results in the confidence bound being close to the mean trend curve.

The probability of moderate damage does not rise quite so steeply and a definitive weight cutoff between birds that cause damage and those that do not cause damage cannot be identified. The probability of moderate damage reaches 50 percent at 15 ounces and 90 percent at 92 ounces. The confidence bound shown in figure 6.2 is further from the mean trend than the confidence bound in figure 6.1 because the trend in the probability of moderate damage as a function of bird weight is not as strong as the trend in the probability of any damage.

The analysis of the severe damage data did not show a significant trend in the probability of damage as a function of bird weight. The estimated curve, shown in figure 6.3, shows a slight rise which means that more data might show a statistically significant trend; however, with the current data there is insufficient evidence that the probability of severe damage is related to bird weight.

The probability of damage analysis is also clouded by the poor bird identification rates. The estimated POD functions are likely to be biased toward higher POD values since there was a larger proportion of birds identified when engine damage occurred. The extent of the bias cannot be estimated accurately.

## 6.3 CREW ACTION AND ENGINE SHUTDOWN PROBABILITIES.

Two other factors that relate to the severity of engine damage are whether or not an unusual crew action is required and whether or not an engine was shut down as a result of the ingestion. Table 6.4 lists the conditional probabilities that an unusual crew action is required given the severity of damage that the engine incurs. The probability that an unusual crew action is required increases with the severity of engine damage as expected. The third column of table 6.4 contains the upper 95 percent confidence bound on the conditional probabilities given in column two.

The formulae for the estimates of the conditional probability of an unusual crew action given the engine damage severity are:

$$\hat{P} = \frac{C}{N_s} \qquad (6.2)$$

$$P_{CB} = \hat{P} + 1.645 \quad \frac{\hat{P}\ (1-P)}{N_s} \qquad (6.3)$$

In equations (6.2) and (6.3), $\hat{P}$ is the estimated conditional probability of a crew action, C is the number of aircraft ingestion events in which a crew action was taken and an engine sustained the given severity level, $N_s$ is the number of aircraft ingestion events in which an engine sustained the given severity level and $P_{CB}$ is the upper confidence bound on the conditional probability. The constant 1.645 is derived from the cumulative normal distribution function to give a 95 percent level of confidence.

An in-flight engine shutdown occurred in eight of the 302 aircraft ingestion events; which corresponds to an estimated probability of an in-flight engine shutdown given that an ingestion has occurred of 0.027 with a 95 percent confidence bound of 0.042. The reason for the shutdown was not known in three of the events. An involuntary shutdown occurred twice, excessive vibration precipitated the shutdown twice and the engine was shut down because of the incorrect engine pressure ratio once. Inferences about the causes of in-flight shutdowns cannot be drawn because of the large proportion of shutdowns in which the cause was not identified.

TABLE 6.4 CONDITIONAL PROBABILITY OF UNUSUAL CREW ACTION (P(CA)) GIVEN THE ENGINE DAMAGE SEVERITY

| Engine Damage Severity | P(CA) | Confidence Bound |
|---|---|---|
| No Damage | 0.13 | 0.17 |
| Damage | 0.29 | 0.36 |
| At Least Moderate Damage | 0.41 | 0.54 |
| Severe Damage | 0.67 | 0.92 |

# SECTION 7

## PROBABILITY ESTIMATES

This section provides a summary of the probabilities of various bird ingestion events. The probability of an event is a measure of the likelihood that the event will occur. The probabilities in this section are calculated on a per operation basis and present similar information to the ingestion rates. The ingestion rates that were presented in Section 4 were calculated on the basis of 10,000 aircraft operations; however, it was shown in Section 4.2 that the per operation ingestion rate is equal to the probability of ingestion for a single operation. This section provides more details on the probabilities of various categories of bird ingestion events.

Table 7.1 provides the estimated probabilities and 95 percent confidence bounds for the whole B737 fleet for various aircraft ingestion events. The overall likelihood of an aircraft ingestion event in a single operation is about 1 in 10,000; and although the odds of having a bird ingestion on any one operation are very small, there are millions of B737 operations each year so that hundreds of ingestions are expected each year. Most ingestions occur during the takeoff and landing phases so that the probabilities for takeoff and climb and the approach and landing phases are relatively large. Dual engine and multiple bird ingestions are relatively rare which is reflected in the smaller probabilities for these events.

The inlet area effect on the probabilities is shown in table 7.2 which separates the probabilities by *location and engine*. The probabilities for the CFMI CFM56 are always larger than the corresponding probabilities for the Pratt and Whitney JT8D. The larger probabilities for the CFM56 are expected since the inlet area of the CFM56 is nearly twice the inlet area of the JT8D.

The effect of bird weight on the probabilities is estimated in tables 7.3 and 7.4. The entries in tables 7.3 and 7.4 were calculated by multiplying the overall probability for each location/engine combination by the relative frequency of each bird weight range. The relative frequencies for bird weight ranges were derived from the frequencies in table 3.2. The validity of this calculation is dependent on the randomness of bird identifications, as discussed in Section 3. Table 7.3 provides a breakdown of probability of ingestion by location and engine while table 7.4 combines the two engine types.

TABLE 7.1 INGESTION PROBABILITIES

| CONDITION | INGESTION EVENTS | PROBABILITY OF INGESTION* | CONFIDENCE BOUND* |
|---|---|---|---|
| All Flights | 302 | 11.00 | 12.06 |
| Takeoff & Climb | 133 | 4.84 | 5.56 |
| Approach & Landing | 71 | 2.59 | 3.15 |
| Dual Engine / Single Bird Per Engine | 9 | 0.33 | 0.57 |
| Dual Engine / Multiple Birds | 3 | 0.11 | 0.28 |
| Multiple Birds / Single Engine | 17 | 0.62 | 0.93 |
| Moderate/Severe Damage | 39 | 1.42 | 1.86 |

* Scaled by $10^5$

TABLE 7.2 INGESTION PROBABLITIES* BY LOCATION AND ENGINE TYPE

| | JT8D ENGINE | | | | | | CFM56 ENGINE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UNITED STATES | | FOREIGN | | WORLDWIDE | | UNITED STATES | | FOREIGN | | WORLDWIDE | |
| Aircraft Operations: | 1,160,091 | | 1,057,633 | | 2,217,724 | | 353,656 | | 174,206 | | 527,862 | |
| Condition Under Consideration | Ing Evt | Ingestion Prob'lity | Ing Evt | Ingestion Prob'lity | Ing Evt | Ingestion Prob'lity | Ing Evt | Ingestion Prob'lity | Ing Evt | Ingestion Prob'lity | Ing Evt | Ingestion Prob'lity |
| All Flights | 40 | 3.45 | 173 | 16.36 | 213 | 9.60 | 40 | 11.31 | 48 | 27.55 | 88 | 16.67 |
| Takeoff And Climb Phases | 26 | 2.24 | 70 | 6.62 | 96 | 4.33 | 20 | 5.66 | 16 | 9.18 | 36 | 6.82 |
| Approach And Landing Phases | 9 | 0.76 | 38 | 3.59 | 47 | 2.12 | 8 | 2.26 | 16 | 9.18 | 24 | 4.55 |
| Dual Engine - Single Bird Events | 1 | 0.09 | 2 | 0.19 | 3 | 0.14 | 2 | 0.58 | 4 | 2.30 | 6 | 1.14 |
| Multiple Birds - Single Engine Events | 0 | - - | 12 | 1.13 | 12 | 0.54 | 1 | 0.28 | 4 | 2.30 | 5 | 0.95 |
| Multiple Birds - Dual Engine Events | 2 | 0.17 | 0 | --- | 2 | 0.09 | 1 | 0.28 | 0 | --- | 1 | 0.19 |
| Moderate Or Severe Damage | 14 | 1.21 | 19 | 1.80 | 33 | 1.49 | 2 | 0.57 | 4 | 2.30 | 6 | 1.14 |

*Ingestion probabilities scaled by $10^5$

TABLE 7.3

PROBABILITIES OF INGESTION* AS A FUNCTION OF BIRD WEIGHT BY LOCATION AND ENGINE TYPE

| | JT8D ENGINE | | | CFM56 ENGINE | | |
|---|---|---|---|---|---|---|
| | US | FOREIGN | WORLDWIDE | US | FOREIGN | WORLDWIDE |
| Aircraft Ops: | 1,160,091 | 1,057,633 | 2,217,724 | 353,656 | 174,206 | 527,862 |
| Bird Wt Range (Oz.) | Prob. of Ingestion | Prob. of Ingestion | Prob. of Ingestion | Prob. of Ingestion | Prob. of Ingestion | Prob. of Ingestion |
| ( $0 < x \leq 4$) | 0.41 | 4.09 | 1.54 | 8.48 | 6.89 | 9.72 |
| ( $4 < x \leq 8$) | 0.41 | 2.04 | 1.15 | 1.41 | 6.89 | 2.78 |
| ( $8 < x \leq 12$) | --- | 2.04 | 0.38 | --- | 13.78 | 2.78 |
| ( $12 < x \leq 16$) | 1.42 | 6.13 | 3.84 | --- | --- | --- |
| ( $16 < x \leq 20$) | 0.20 | --- | 0.38 | --- | --- | --- |
| ⋮ | | | | | | |
| ( $36 < x \leq 40$) | 0.41 | 2.04 | 1.15 | 1.41 | --- | 1.39 |
| ⋮ | | | | | | |
| ( $52 < x \leq 56$) | 0.41 | --- | 0.77 | --- | --- | --- |
| ⋮ | | | | | | |
| ($124 < x \leq 128$) | 0.20 | --- | 0.38 | --- | --- | --- |
| All Events | 3.45 | 16.36 | 9.60 | 11.31 | 27.55 | 16.67 |

* Ingestion probabilities scaled by $10^5$

TABLE 7.4 PROBABILITIES OF INGESTION* AS A FUNCTION OF BIRD WEIGHT BY LOCATION

| | BOEING-737 COMMERCIAL FLEET | | |
|---|---|---|---|
| | UNITED STATES | FOREIGN | WORLDWIDE |
| Aircraft Operations: | 1,513,747 | 1,231,839 | 2,745,586 |
| Bird Weight Range (Ounces) | Probability Of Ingestion | Probability Of Ingestion | Probability Of Ingestion |
| ( 0 < x <= 4) | 1.69 | 4.49 | 3.26 |
| ( 4 < x <= 8) | 0.63 | 2.99 | 1.48 |
| ( 8 < x <= 12) | — | 4.49 | 0.89 |
| ( 12 < x <= 16) | 1.48 | 4.49 | 2.96 |
| ( 16 < x <= 20) | 0.21 | — | 0.30 |
| ⋮ | | | |
| ( 36 < x <= 40) | 0.63 | 1.50 | 1.19 |
| ⋮ | | | |
| ( 52 < x <= 56) | 0.42 | — | 0.59 |
| ⋮ | | | |
| (124 < x <= 128) | 0.21 | — | 0.30 |

*Ingestion probabilities scaled by $10^5$

## SECTION 8

## CONCLUSIONS

The main goal of this bird ingestion investigation is to provide data to better define the nature and extent of the bird ingestion threat. The job of collecting information on bird ingestions is extremely difficult because of the large number of organizations that must cooperate to collect complete and accurate bird ingestion data. The sparsity of information that was collected makes it very difficult to draw strong inferences about the nature of the bird ingestion threat. This section summarizes conclusions from the first year's data for the B737 aircraft.

### Bird Descriptions

Gulls, doves, and lapwings are most often ingested.

There is a better identification rate when the engine is damaged.

Ingestions are seasonal and less likely at night.

### Ingestion Rates

Ingestion events can be modeled as a Poisson process.

It appears that ingestion rates are proportional to either the inlet area or diameter of the engine (i.e. there is no statistically significant difference between the ingestion rates of the JT8D and the CFM56 after adjusting for inlet area or diameter.)

### Airport Experiences

More bird ingestions were reported at foreign airports than at United States airports and the ingestion rates for foreign operations were higher than for United States operations.

The 19 airports that reported three or more ingestions represented 14 percent of the airports that experienced ingestions and accounted for 25 percent of all ingestion events.

### Engine Damage

Some types of engine damage are correlated with other types of damage.

There is some evidence that the probability of any damage increases with the weight of the bird that is ingested; however, there is insufficient data to establish a weight relationship to severe damage.

Unusual crew actions are more likely when more severe damage is inflicted on an engine.

Required in-flight engine shutdowns occur in less than five percent of all ingestion events.

Probabilities of Ingestion

Bird ingestions are more likely during the take-off and landing phases of an aircraft operation.

## SECTION 9

## REFERENCES


1. Frings, G., "A Study of Bird Ingestions into Large High Bypass Ratio Turbine Aircraft Engines," DOT/FAA/CT-84/13, Department of Transportation, Federal Aviation Administration, September 1984.

2. Berens, A.P., West, B.W., and Turella, M.A., "On a Probabilistic Model for Evaluating the Birdstrike Threat to Aircraft Crew Enclosures," UDR-TR-78-124, University of Dayton Research Institute, Dayton, OH, November 1978.

3. Skinn, D.A. and Berens, A.P., "Bird Avoidance Model (BAM) Phase I Report: Feasibility Demonstration," UDR-TR-80-122, University of Dayton Research Institute, Dayton, OH, November 1980.

4. Liliefors, H.W., "On the Kilmogorov-Smirnov Test for the Exponential Distribution with Mean Unknown," Journal of the American Statistical Assoc., Vol. 64, March 1969, pp. 387-389.

5. Bertke, R.S. and Hovey, P.W., "Glass/Acrylic Coupon Impact Testing," UDR-TR-82-145, University of Dayton Research Institute, Dayton, OH, November 1982.

6. Cox, D.R., "The Analysis of Binary Data," Department of Mathematics Imperial College, Methuen & Co., Ltd., London, England, 1970.

7. Fienberg, S.E., "The Analysis of Cross-Classified Categorical Data," IBSN 0-262-06063-9, MIT Press, 1977.

8. Berens, A.P., Hovey, P.W., Donahue, R.M., and Craport, W.M., "User's Manual for Probability of Detection Software System (POD/SS)," UDR-TR-88-12, University of Dayton Research Institute, Dayton, OH, January 1988.

# SECTION 10

## GLOSSARY

| Term | Definition of Term |
| --- | --- |
| Engine Ingestion Event | Process whereby one or more birds pass through the engine inlet during engine operation. |
| Ingested Bird | A bird having experienced the process of engine ingestion event. |
| Aircraft Ingestion Event | Simultaneous ingestion of one or more birds into one or more engines of an aircraft. |
| Airport Operation | Takeoff (departure) from an airport or a landing (arrival) at an airport. |
| Aircraft Operation | A nonstop aircraft flight from one airport to another. (Includes time from taxi-out from departure airport through taxi-in at arrival airport.) |
| Engine Operation | The participation of each engine of an aircraft in an aircraft operation (e.g., a twin engine aircraft would, ideally, experience two engine operations for each aircraft operation). |
| Ingestion Rate | The number of aircraft or engine ingestion events per flight event. Flight event refers to aircraft, engine or airport operation. The components of ingestion rate are specified when used in the report. The influence of engine inlet area is not considered. |
| Normalized Ingestion Rate | Ingestion rate adjusted to a given nominal area. Allows statistical comparison of ingestion rates of engines with different inlet areas. |

APPENDIX A

AIRPORTS WITH SCHEDULED BOEING-737 FLIGHTS
AND/OR REPORTED BIRD INGESTION EVENTS

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| AAE | ANNABA, ALGERIA | N | NO | -0- | 2393 |
| AAY | AL GHAYDAH, YEMEN | N | NO | -0- | 210 |
| ABE | ALLENTOWN, PA, USA | N | YES | PA | 370 |
| ABJ | ABIDJAN, COTE D'IVORE (IVORY COAST) | N | NO | -0- | 1620 |
| ABQ | ALBUQUERQUE, NM, USA | N | YES | NM | 41942 |
| ABS | ABU SIMBEL, ARAB REP OF EGYPT | N | NO | -0- | 3366 |
| ABT | AL BAHA, SAUDI ARABIA | N | NO | -0- | 1148 |
| ABV | ABUJA, NIGERIA | N | NO | -0- | 1240 |
| ABZ | ABERDEEN, SCOTLAND | N | NO | -0- | 1519 |
| ACA | ACAPULCO, MEXICO | N | NO | -0- | 126 |
| ACC | ACCRA, GHANA | N | NO | -0- | 486 |
| ACE | LANZAROTE, CANARY ISLANDS | N | NO | -0- | 76 |
| ACV | EUREKA ARCATA, CA, USA | N | YES | CA | 2616 |
| ADD | ADDIS ABABA, ETHIOPIA | N | NO | -0- | 148 |
| ADE | ADEN, YEMEN | N | NO | -0- | 1346 |
| ADL | ADELAIDE SA AUSTRALIA | S | NO | -0- | 4738 |
| ADQ | KODIAK, AS, US | N | NO | AS | 2290 |
| ADZ | SAN ANDRES ISLAND, COLOMBIA | N | NO | -0- | 526 |
| AEP | BUENOS AIRES - NEWBERY, ARGENTINA | S | NO | -0- | 23291 |
| AES | AALESUND, NORWAY | N | NO | -0- | 8988 |
| AGA | AGADOR, MOROCCO | N | NO | -0- | 601 |
| AGP | MALAGA, SPAIN | N | NO | -0- | 2434 |
| AGR | AGRA, INDIA | N | NO | -0- | 1980 |
| AGS | AUGUSTA, GA, USA | N | YES | GA | 1579 |
| AHB | ABHA, SAUDI ARABIA | N | NO | -0- | 2026 |
| AHU | AL HOCEIMA, MOROCCO | N | NO | -0- | 292 |
| AJA | AJACCIO, CORSICA, FRANCE | N | NO | -0- | 59 |
| AJF | JOUF, SAUDI ARABIA | N | NO | -0- | 1128 |
| AJU | ARACAJU, BRAZIL | S | NO | -0- | 1460 |
| AKL | AUCKLAND, NEW ZEALAND | S | NO | -0- | 16985 |
| AKN | KING SALMON, AS, US | N | NO | AS | 1444 |
| AKR | AKURE, NIGERIA | N | NO | -0- | 238 |
| ALB | ALBANY, NY, USA | N | YES | NY | 4461 |
| ALC | ALICANTE, SPAIN | N | NO | -0- | 148 |
| ALG | ALGIERS, ALGERIA | N | NO | -0- | 14258 |
| ALY | ALEXANDRIA, ARA REP OF EGYPT | N | NO | -0- | 2104 |
| AMA | AMARILLO, TX, USA | N | YES | TX | 12811 |
| AMD | AHMEDABAD, INDIA | N | NO | -0- | 5932 |
| AMM | AMMAN, JORDAN | N | NO | -0- | 2131 |
| AMS | AMSTERDAM, NETHERLANDS | N | NO | -0- | 19047 |
| ANC | ANCHORAGE, AS, US | N | NO | AS | 18977 |
| ANF | ANTOFAGASTA, CHILE | S | NO | -0- | 1434 |
| ANI | ANIAK, AS, US | N | NO | AS | 460 |
| ANR | ANTWERP, BELGIUM | N | NO | -0- | 540 |
| ANU | ANTIGUA, WEST INDIES | N | NO | -0- | 18 |
| AOR | ALOR SETAR, MALAYSIA | N | NO | -0- | 1886 |
| APL | NAMPULA, MOZAMBIQUE | S | NO | -0- | 1144 |
| APW | APIA, WESTERN SAMOA | S | NO | -0- | 858 |
| AQI | QAISUMAH, SAUDI ARABIA | N | NO | -0- | 494 |
| ARI | ARICA, CHILE | S | NO | -0- | 970 |
| ARN | STOCKHOLM ARLANDA, SWEDEN | N | NO | -0- | 7556 |
| ASP | ALICE SPRINGS, N.T., AUSTRALIA | S | NO | -0- | 1816 |
| ASU | ASUNCION, PARAGUAY | S | NO | -0- | 498 |
| ASW | ASWAN, ARAB REP OF EGYPT | N | NO | -0- | 4968 |
| ATH | ATHENS, GREECE | N | NO | -0- | 24758 |
| ATL | ATLANTA, GA, USA | N | YES | GA | 42143 |
| ATM | ALTAMIRA, BRAZIL | S | NO | -0- | 416 |
| ATQ | AMRITSAR, INDIA | N | NO | -0- | 1846 |
| AUA | ARUBA, ARUBA | N | NO | -0- | 50 |
| AUH | ABU DHABI, U. A. EMIRATES | N | NO | -0- | 4023 |
| AUS | AUSTIN, TX, USA | N | YES | TX | 33326 |
| AUX | ARAGUAINA, BRAZIL | S | NO | -0- | 244 |
| AVL | ASHEVILLE, NC, USA | N | YES | NC | 1298 |
| AVP | WILKES-BARRE/SCRANTON, PA, USA | N | YES | PA | 114 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| AXD | ALEXANDROUPOLIS, GREECE | N | NO | -0- | 908 |
| AXT | AKITA, JAPAN | N | NO | -0- | 591 |
| AYT | ANTALYA, TURKEY | N | NO | -0- | 52 |
| AZO | KALAMAZOO, MI, USA | N | YES | MI | 2800 |
| AZR | ADRAR, ALGERIA | N | NO | -0- | 818 |
| BAH | BAHRAIN, BAHRAIN | N | NO | -0- | 11933 |
| BAQ | BARRANQUILLA, COLOMBIA | N | NO | -0- | 105 |
| BBI | BHUBANESWAR, INDIA | N | NO | -0- | 2086 |
| BCN | BARCELONA, SPAIN | N | NO | -0- | 4166 |
| BDH | BANDAR LENGEH, IRAN | N | NO | -0- | 1460 |
| BDL | HARTFORD, CN, USA | N | YES | CN | 15001 |
| BDQ | VADODARA, INDIA | N | NO | -0- | 1925 |
| BDT | BADO LITE, ZAIRE | N | NO | -0- | 208 |
| BEG | BELGRADE, YUGOSLAVIA | N | NO | -0- | 10759 |
| BEL | BELEM, BRAZIL | S | NO | -0- | 5505 |
| BET | BETHEL, AS, US | N | NO | AS | 3190 |
| BEW | BEIRA, MOZAMBIQUE | S | NO | -0- | 1304 |
| BFL | BAKESFIELD, CA, USA | N | YES | CA | 2742 |
| BFN | BLOEMFONTEIN, SOUTH AFRICA | S | NO | -0- | 3954 |
| BFS | BELFAST, N. IRELAND | N | NO | -0- | 1570 |
| BGF | BANGUI, CEN. AFRICAN REPUBLIC | N | NO | -0- | 272 |
| BGI | BARBADOS, BARBADOS | N | NO | -0- | 52 |
| BGO | BERGEN, NORWAY | N | NO | -0- | 12038 |
| BHH | BISHA, SAUDI ARABIA | N | NO | -0- | 1740 |
| BHI | BAHIA BLANCA, ARGENTINA | S | NO | -0- | 2162 |
| BHJ | BHUJ, INDIA | N | NO | -0- | 730 |
| BHM | BIRMINGHAM, AL, USA | N | YES | AL | 6048 |
| BHO | BHOPAL, INDIA | N | NO | -0- | 1828 |
| BHU | BHAVNAGAR, INDIA | N | NO | -0- | 730 |
| BHX | BIRMINGHAM, ENGLAND (UK) | N | NO | -0- | 2307 |
| BIA | BASTIA, CORSICA, FRANCE | N | NO | -0- | 234 |
| BIL | BILLINGS, MT, USA | N | YES | MT | 7285 |
| BIO | BILBAO, SPAIN | N | NO | -0- | 622 |
| BIQ | BIARRITZ, FRANCE | N | NO | -0- | 52 |
| BIS | BISMARCK, ND, USA | N | YES | ND | 3396 |
| BJL | BANJUL, GAMBIA | N | NO | -0- | 472 |
| BJM | BUJUMBURA, BURUNDI | S | NO | -0- | 245 |
| BKI | KOTA KINABALU, SABAH, MALAYSIA | N | NO | -0- | 8699 |
| BKK | BANGKOK, THAILAND | N | NO | -0- | 7329 |
| BKO | BAMAKO, MALI | N | NO | -0- | 50 |
| BKY | BUKAVU, ZAIRE | S | NO | -0- | 104 |
| BLL | BILLUND, DENMARK | N | NO | -0- | 2177 |
| BLQ | BOLOGNA, ITALY | N | NO | -0- | 310 |
| BLR | BANGALORE, INDIA | N | NO | -0- | 5886 |
| BNA | NASHVILLE, TN, USA | N | YES | TN | 17920 |
| BND | BANDAR ABBAS, IRAN | N | NO | -0- | 1460 |
| BNE | BRISBANE, QLD, AUSTRALIA | S | NO | -0- | 12830 |
| BNI | BENIN CITY, NIGERIA | N | NO | -0- | 2127 |
| BOD | BORDEAUX, FRANCE | N | NO | -0- | 688 |
| BOI | BOISE, ID, USA | N | YES | ID | 5399 |
| BOM | BOMBAY, INDIA | N | NO | -0- | 16848 |
| BOO | BODO, NORWAY | N | NO | -0- | 2868 |
| BOS | BOSTON, MA, USA | N | YES | MA | 30820 |
| BRC | SAN CARLOS DE BARILOCHE, ARGENTINA | S | NO | -0- | 1663 |
| BRE | BREMEN, FED REP OF GERMANY | N | NO | -0- | 4526 |
| BRS | BRISTOL, ENGLAND (UK) | N | NO | -0- | 2 |
| BRU | BRUSSELS, BELGIUM | N | NO | -0- | 31942 |
| BRW | BARROW, AS, US | N | NO | AS | 1897 |
| BSB | BRASILIA, BRAZIL | S | NO | -0- | 22788 |
| BSL | BASEL/MULHOUSE, SWITZERLAND | N | NO | -0- | 554 |
| BTM | BUTTE, MT, USA | N | YES | MT | 1460 |
| BTR | BATON ROUGE, LA, USA | N | YES | LA | 2944 |
| BTV | BURLINGTON, VT, USA | N | YES | VT | 2544 |
| BUD | BUDAPEST, HUNGARY | N | NO | -0- | 1660 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| BUF | BUFFALO, NY, USA | N | YES | NY | 17704 |
| BUQ | BULAWAYO, ZIMBABWE | S | NO | -0- | 1834 |
| BUR | BURBANK, CA, USA | N | YES | CA | 11187 |
| BUX | BUNA, ZAIRE | N | NO | -0- | 210 |
| BUZ | BUSHEHR, IRAN | N | NO | -0- | 88 |
| BVB | BOA VISTA, BRAZIL | N | NO | -0- | 1314 |
| BWI | BALTIMORE, MD, USA | N | YES | MD | 54435 |
| BWN | BASERI BEGAWAN, BRUNEI DARUSSALAM | N | NO | -0- | 2951 |
| BXO | BISSAU, GUINEA BISSAU | N | NO | -0- | 20 |
| BZE | BELIZE CITY, BELIZE | N | NO | -0- | 3647 |
| BZN | BOZEMAN, MT, USA | N | YES | MT | 5200 |
| BZV | BRAZZAVILE, PEOP REP OF CONGO | S | NO | -0- | 1406 |
| CAB | CABINDA, ANGOLA | S | NO | -0- | 1042 |
| CAE | COLUMBIA, SC, USA | N | YES | SC | 8213 |
| CAI | CAIRO, ARAB REP OF EGYPT | N | NO | -0- | 8057 |
| CAK | AKRON/CANTON, OH, USA | N | YES | OH | 2241 |
| CAN | GUANGZHOU, P. R. CHINA | N | NO | -0- | 13955 |
| CAS | CASABLANCA, MOROCCO | N | NO | -0- | -0- |
| CAY | CAYENNE, FRENCH GUIANA | N | NO | -0- | 208 |
| CBD | CAR NICOBAR, INDIA | N | NO | -0- | 40 |
| CBH | BECHAR, ALGERIA | N | NO | -0- | 1455 |
| CBQ | CALABAR, NIGERIA | N | NO | -0- | 1935 |
| CBR | CANBERRA, A.C.T, AUTSTRALIA | S | NO | -0- | 5600 |
| CCP | CONCEPCION, CHILE | S | NO | -0- | 1184 |
| CCU | CALCUTTA, INDIA | N | NO | -0- | 10798 |
| CDG | PARIS DE GAULLE, FRANCE | N | NO | -0- | 25514 |
| CDV | CORDOVA, AS, US | N | NO | AS | 1514 |
| CEO | WACO KUNGO, ANGOLA | S | NO | -0- | 10 |
| CFU | CORFU, GREECE | N | NO | -0- | 746 |
| CGB | CUIABA MATO GROSSO, BRAZIL | S | NO | -0- | 9184 |
| CGH | SAO PAULO-CONGONHAS, BRAZIL | S | NO | -0- | 1082 |
| CGK | JAKARTA-SOEKARNO, INDONESIA | S | NO | -0- | 626 |
| CGN | COLOGNE BONN, FRG | N | NO | -0- | 18161 |
| CGO | ZHENGZHOU, P. R. CHINA | N | NO | -0- | 208 |
| CGQ | CHANGCHUN, P. R. CHINA | N | NO | -0- | 62 |
| CGR | CAMPO GRANDE, BRAZIL | S | NO | -0- | 6770 |
| CHA | CHATTANOOGA, TN, USA | N | YES | TN | 1618 |
| CHC | CHRISTCHURCH, NEW ZEALAND | S | NO | -0- | 17095 |
| CHO | CHARLOTTESVILLE, VA, USA | N | YES | VA | 1814 |
| CHQ | CHANIA, CRETE, GREECE | N | NO | -0- | 856 |
| CHS | CHARLESTON, SC, USA | N | YES | SC | 7219 |
| CID | CEDAR RAPIDS/IOWA CITY, IO, USA | N | YES | IO | 3800 |
| CIX | CHICLAYO, PERU | S | NO | -0- | 286 |
| CJB | COIMBATORE, INDIA | N | NO | -0- | 1528 |
| CJC | CALAMA, CHILE | S | NO | -0- | 626 |
| CKG | CHONGQING, P. R. CHINA | N | NO | -0- | 714 |
| CKS | CARAJAS, BRAZIL | S | NO | -0- | 417 |
| CKY | CONAKRY, GUINEA | N | NO | -0- | 550 |
| CLE | CLEVELAND, OH, USA | N | YES | OH | 24028 |
| CLT | CHARLOTTE, NC, USA | N | YES | NC | 95251 |
| CMB | COLOMBO, SRI LANKA | N | NO | -0- | 3021 |
| CMG | CORUMBA, MATO GROSSO, BRAZIL | S | NO | -0- | 1460 |
| CMH | COLUMBUS, OH, USA | N | YES | OH | 8004 |
| CMI | CHAMPAIGN, IL, USA | N | YES | IL | 2186 |
| CMN | MOHAMEDV, CASABLANCA, MOROCCO | N | NO | -0- | 4767 |
| CNF | BELO HORIZONTE-CONFINS, BRAZIL | S | NO | -0- | 19683 |
| CNQ | CORRIENTES, ARGENTINA | S | NO | -0- | 1100 |
| CNS | CAIRNS, QLD, AUSTRALIA | S | NO | -0- | 4850 |
| CNX | CHIANG MAI, THAILAND | N | NO | -0- | 728 |
| COK | COCHIN, INDIA | N | NO | -0- | 5457 |
| COO | COTONOU, BENIN | N | NO | -0- | 1120 |
| COR | CORDOBA, ARGENTINA | S | NO | -0- | 6772 |
| COS | COLORADO SPRINGS, CO, USA | N | YES | CO | 8004 |
| CPH | COPENHAGEN, DENMARK | N | NO | -0- | 11419 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| CPQ | CAMPINAS, BRAZIL | S | NO | -0- | 1056 |
| CPR | CASPER, WY, USA | N | YES | WY | 4230 |
| CPT | CAPE TOWN, SOUTH AFRICA | S | NO | -0- | 8545 |
| CPV | CAMPINA GRANDE, BRAZIL | S | NO | -0- | 626 |
| CRD | COMODORO RIVADAVIA, ARGENTINA | S | NO | -0- | 2553 |
| CRP | CORPUS CHRISTI, TX, USA | N | YES | TX | 5584 |
| CRW | CHARLESTON, WV, USA | N | YES | WV | 4478 |
| CTA | CATANIA, ITALY | N | NO | -0- | 252 |
| CTC | CATAMARCA, ARGENTINA | S | NO | -0- | 778 |
| CTG | CARTAGENA, COLOMBIA | N | NO | -0- | 105 |
| CTS | SAPPORO-CHITOSE, JAPAN | N | NO | -0- | 1398 |
| CTU | CHENGDU, P.R. CHINA | N | NO | -0- | 2138 |
| CUN | CANCUN, MEXICO | N | NO | -0- | 634 |
| CUR | CURACAO, NETH ANTILLES | N | NO | -0- | 20 |
| CVG | CINCINNATI, OH, USA | N | YES | OH | 14496 |
| CWB | CURITIBA, PARANA, BRAZIL | S | NO | -0- | 6532 |
| CXI | CHRISTMAS ISLAND, REP OF KIRIBATI | N | NO | -0- | 106 |
| CYI | CHIAYI, TAIWAN | N | NO | -0- | 730 |
| CZL | CONSTANTINE, ALGERIA | N | NO | -0- | 3352 |
| CZS | CRUZEIRO DO SUL, ACRE, BRAZIL | S | NO | -0- | 344 |
| CZX | CHANGZHOU, P. R. CHINA | N | NO | -0- | 208 |
| DAB | DAYTONA BEACH, FL, USA | N | YES | FL | 3532 |
| DAC | DHAKA, BANGLADESH | N | NO | -0- | 934 |
| DAL | LOVE DALLS/FT. WORTH, TX, USA | N | YES | TX | 75124 |
| DAM | DAMASCUS, SYRIA | N | NO | -0- | 523 |
| DAR | DAR ES SALAAM, TANZANIA | S | NO | -0- | 3407 |
| DAY | DAYTON, OH, USA | N | YES | OH | 37652 |
| DBV | DUBROVNIK, YUGOSLAVIA | N | NO | -0- | 1806 |
| DCA | NATIONAL, WASHINGTON, DC, USA | N | YES | DC | 22108 |
| DEC | DECATUR, IL, USA | N | YES | IL | 0 |
| DEL | DELHI, INDIA | N | NO | -0- | 15987 |
| DEN | STAPLETON INT'L, DENVER, CO, USA | N | YES | CO | 112673 |
| DFW | DALLAS/FT WORTH, TX, USA | N | YES | TX | 51130 |
| DHA | DHAHRAN, SAUDI ARABIA | N | NO | -0- | 7902 |
| DIB | DIBRUGARH, INDIA | N | NO | -0- | 816 |
| DIE | ANTSIRANANA, MADAGASCAR | S | NO | -0- | 610 |
| DIR | DIRE DAWA, ETHIOPIA | N | NO | -0- | 38 |
| DJE | DJERBA, TUNISIA | N | NO | -0- | 547 |
| DJG | DJANET, ALGERIA | N | NO | -0- | 466 |
| DKR | DAKAR, SENEGAL | N | NO | -0- | 467 |
| DLA | DOUALA, REP OF CAMEROON | N | NO | -0- | 5262 |
| DLG | DILLINGHAM, AS,US | N | NO | AS | 1444 |
| DOD | DODOMA, TANZANIA | S | NO | -0- | 16 |
| DOH | DOHA, QATAR | N | NO | -0- | 8859 |
| DPS | DENPASAR, INDONESIA | S | NO | -0- | 104 |
| DRO | DURANGO, CO, USA | N | YES | CO | 2233 |
| DRW | DARWIN, N.T., AUSTRALIA | S | NO | -0- | 1107 |
| DSM | DES MOINES, IO, USA | N | YES | IO | 7748 |
| DTW | WAYNE CO, DETROIT, MI, USA | N | YES | MI | 16765 |
| DUB | DUBLIN, REPUBLIC OF IRELAND | N | NO | -0- | 19308 |
| DUD | DUNEDIN, NEW ZEALAND | S | NO | -0- | 4145 |
| DUR | DURBAN, SOUTH AFRICA | S | NO | -0- | 6925 |
| DUS | DUESSELDORF, FRG | N | NO | -0- | 30119 |
| DUT | DUTCH HARBOR, AS, US | N | NO | AS | 828 |
| DXB | DUBAI, U. A. EMIRATES | N | NO | -0- | 3134 |
| EAM | NEJRAN, SAUDI ARABIA | N | NO | -0- | 2392 |
| EBB | ENTEBBE KAMPALA, UGANDA | N | NO | -0- | 39 |
| EBD | EL OBEID, SUDAN | N | NO | -0- | 632 |
| EBJ | ESBJERG, DENMARK | N | NO | -0- | 482 |
| EDI | EDINBURGH, SCOTLAND | N | NO | -0- | 1040 |
| EFL | KEFALONIA, GREECE | N | NO | -0- | 780 |
| EJH | WEDJH, SAUDI ARABIA | N | NO | -0- | 784 |
| ELG | EL GOLEA, ALGERIA | N | NO | -0- | 416 |
| ELP | EL PASO, TX, USA | N | YES | TX | 38902 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| ELQ | GASSIM, SAUDI ARABIA | N | NO | -0- | 4652 |
| ELS | EAST LONDON, SOUTH AFRICA | S | NO | -0- | 9987 |
| ELU | EL OUED, ALGERIA | N | NO | -0- | 288 |
| EMA | EAST MIDLANDS, ENGLAND | N | NO | -0- | 291 |
| ENU | ENUGU, NIGERIA | N | NO | -0- | 3138 |
| EQS | ESQUEL, ARGENTINA | S | NO | -0- | 1116 |
| ERI | ERIE, PA, USA | N | YES | PA | 1772 |
| ESR | EL SALVADOR, CHILE | S | NO | -0- | 836 |
| ETH | ELAT, ISRAEL | N | NO | -0- | 4 |
| EUG | EUGENE, OR, USA | N | YES | OR | 3493 |
| EUN | LAAYOUNE, MOROCCO | N | NO | -0- | 244 |
| EVE | EVENES, NORWAY | N | NO | -0- | 1520 |
| EVV | EVANSVILLE, IN, USA | N | YES | IN | 2468 |
| EWR | NEWARK, NEW YORK, NY, USA | N | YES | NY | 78323 |
| EZE | BUENOS AIRES-EZEIZA ARPT, ARGENTINA | S | NO | -0- | 424 |
| FAE | FAROE ISLANDS, DENMARK | N | NO | -0- | 756 |
| FAI | FAIRBANKS, AS, US | N | NO | AS | 3674 |
| FAO | FARO, PORTUGAL | N | NO | -0- | 1069 |
| FAR | FARGO, ND, USA | N | YES | ND | 1561 |
| FAT | FRESNO, CA, USA | N | YES | CA | 9993 |
| FAY | FAYETTEVILLE, NC, USA | N | YES | NC | 3260 |
| FBM | LUBUMBASHI, ZAIRE | S | NO | -0- | 262 |
| FBU | FORNEBU, OSLO, NORWAY | N | NO | -0- | 11420 |
| FCA | KALISPELL GLACIER NAT'L OK, MT, USA | N | YES | MT | 1460 |
| FCO | DA VINCI, ROME, ITALY | N | NO | -0- | 4538 |
| FEZ | FEZ, MOROCCO | N | NO | -0- | 146 |
| FIH | KINSHASA, ZAIRE | S | NO | -0- | 2324 |
| FKI | KISANGANI, ZAIRE | N | NO | -0- | 1170 |
| FLL | FT LAUDERDALE, FL, USA | N | YES | FL | 12566 |
| FLN | FLORIANOPOLIS, BRAZIL | S | NO | -0- | 4180 |
| FMA | FORMOSA, ARGENTINA | S | NO | -0- | 682 |
| FMI | KALEMIE, ZAIRE | S | NO | -0- | 524 |
| FNA | FREETOWN, SIERRA LEONE | N | NO | -0- | 112 |
| FNC | FUNCHAL - MADEIRA, PORTUGAL | N | NO | -0- | 3737 |
| FNT | FLINT, MI, USA | N | YES | MI | 2186 |
| FOC | FUZHOU, P. R. CHINA | N | NO | -0- | 534 |
| FOE | FORBES, TOPEKA, KA, USA | N | YES | KA | 1407 |
| FOR | FORTALEZA, CEARA, BRAZIL | S | NO | -0- | 4798 |
| FPO | FREEPORT, BAHAMAS | N | NO | -0- | 2666 |
| FRA | FRANKFURT, FRG | N | NO | -0- | 52274 |
| FSD | SIOUX FALLS, SD, USA | N | YES | SD | 6410 |
| FTU | FT DAUPHIN, MADAGASCAR | S | NO | -0- | 332 |
| FUK | FUKUOKA, JAPAN | N | NO | -0- | 730 |
| FWA | FT WAYNE, IN, USA | N | YES | IN | 2580 |
| GAJ | YAMAGATA, HONSHU, JAPAN | N | NO | -0- | 1154 |
| GAU | GAUHATI, INDIA | N | NO | -0- | 3934 |
| GBE | GABORONE, BOTSWANA | S | NO | -0- | 527 |
| GEG | SPOKANE, WA, USA | N | YES | WA | 8549 |
| GHA | GHARDAIA, ALGERIA | N | NO | -0- | 1014 |
| GHB | GOVERNORS HARBOUR, BAHAMAS | N | NO | -0- | 36 |
| GHU | GUALEGUAYCHU, ARGENTINA | S | NO | -0- | -0- |
| GIB | GIBRALTAR, GIBRALTAR | N | NO | -0- | 1788 |
| GIG | RIO DE JANEIRO INT'L, BRAZIL | S | NO | -0- | 27048 |
| GIZ | GIZAN, SAUDI ARABIA | N | NO | -0- | 5781 |
| GJT | GRAND JUNCTION, CO, USA | N | YES | CO | 2416 |
| GLA | GLASGLOW, SCOTLAND | N | NO | -0- | 687 |
| GMA | GEMENA, ZAIRE | N | NO | -0- | 312 |
| GOA | GENOA, ITALY | N | NO | -0- | 292 |
| GOI | GOA, INDIA | N | NO | -0- | 1798 |
| GOM | GOMA, ZAIRE | S | NO | -0- | 104 |
| GOP | GORAKHPUR, INDIA | N | NO | -0- | 486 |
| GOT | GOTHENBURG, SWEDEN | N | NO | -0- | 3846 |
| GOU | GAROUA, REP OF CAMEROON | N | NO | -0- | 1954 |
| GOV | GOVE, N.T., AUSTRALIA | S | NO | -0- | 314 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| GRB | GREEN BAY, WI, USA | N | YES | WI | 685 |
| GRJ | GEORGE, SOUTH AFRICA | S | NO | -0- | 2178 |
| GRR | GRAND RAPIDS, MI, USA | N | YES | MI | 4831 |
| GRU | SAO PAULO-GUARULMOS, BRAZIL | S | NO | -0- | 41861 |
| GRZ | GRAZ, AUSTRIA | N | NO | -0- | 619 |
| GSO | GREENSBORO/HPT/WIN-SALEM, NC, USA | N | YES | NC | 18586 |
| GSP | GREENVILLE/SPARTANBURG, SC, USA | N | YES | SC | 1508 |
| GTF | GREAT FALLS, MT, USA | N | YES | MT | 4356 |
| GUA | GUATELMALA CITY, GUATEMALA | N | NO | -0- | 1667 |
| GUM | GUAM, GUAM | N | NO | -0- | 289 |
| GVA | GENEVA, SWITZERLAND | N | NO | -0- | 10594 |
| GWL | GWALIOR, INDIZ | N | NO | -0- | 1460 |
| GWT | GALWAY, IRELAND | N | NO | -0- | 130 |
| GXF | SEIYUN, YEMEN | N | NO | -0- | 26 |
| GXG | NEGAGE, ANGOLA | S | NO | -0- | 382 |
| GYE | GUAYAQUIL,ECUADOR | S | NO | -0- | 1609 |
| GYN | GOIANIA, BRAZIL | S | NO | -0- | 7891 |
| HAC | HACHIJO, JIMA ISLAND, JAPAN | N | NO | -0- | 834 |
| HAH | MORONI-HAHAYA, COMOROS | S | NO | -0- | 266 |
| HAJ | HANOVER, FED REP OF GERMANY | N | NO | -0- | 8844 |
| HAK | HAIKOU, P. R. CHINA | N | NO | -0- | 770 |
| HAM | HAMBURG, FRG | N | NO | -0- | 25535 |
| HAN | HANOI, SOC REP OF VIETNAM | N | NO | -0- | 152 |
| HAS | HAIL, SAUDI ARABIA | N | NO | -0- | 3842 |
| HBA | HOBART, TASMANIA, AUSTRALIA | S | NO | -0- | 3785 |
| HBT | HAFR ALBAPIN, SAUDI ARABIA | N | NO | -0- | 140 |
| HDY | HAT YAI, THAILAND | N | NO | -0- | 3094 |
| HEL | HELSINKI, FINLAND | N | NO | -0- | 2797 |
| HER | HERAKLION, GREECE | N | NO | -0- | 1790 |
| HGH | HANGZHOU, P. R. CHINA | N | NO | -0- | 1390 |
| HIR | HONIARA, GUADALCANAL, SOLOMON IS. | S | NO | -0- | 436 |
| HJR | HIROSHIMA, JAPAN | N | NO | -0- | 1460 |
| HKD | HAKODATE, JAPAN | N | NO | -0- | 1030 |
| HKG | HONG KONG, HONG KONG | N | NO | -0- | 2792 |
| HKT | PHUKET, THAILAND | N | NO | -0- | 1932 |
| HLN | HELENA, MT, USA | N | YES | MT | 2046 |
| HLZ | HAMILTON, NEW ZEALAND | S | NO | -0- | 627 |
| HME | HASSI MESSAOUD, ALGERIA | N | NO | -0- | 256 |
| HND | TOKYO-HANEDA, JAPAN | N | NO | -0- | 14398 |
| HNL | HONOLULU, OAHU, HA, USA | N | NO | HA | 51139 |
| HOD | HODEIDAH, YEMEN | N | NO | -0- | 86 |
| HOF | HOFUF, SAUDI ARABIA | N | NO | -0- | 992 |
| HOR | HORTA FAIAL ISLAND, PORTUGAL | N | NO | -0- | 92 |
| HOU | HOUSTON, TX, USA | N | YES | TX | 71429 |
| HPN | WHITE PLAINS, NY, USA | N | YES | NY | 2159 |
| HRB | HARBIN, MANCHURIA, P. R. CHINA | N | NO | -0- | 210 |
| HRE | HARARE, ZIMBABWE | S | NO | -0- | 3314 |
| HRG | HORGHADA, ARAB REP OF EGYPT | N | NO | -0- | 760 |
| HRL | HARLINGEN, TX, USA | N | YES | TX | 7446 |
| HSV | HUNTSVILLE/DECATUR, AL, USA | N | YES | AL | 1817 |
| HTI | HAMILTON ISLAND, QLD, AUSTRALIA | S | NO | -0- | 1351 |
| HTS | HUNTINGTON, WV, USA | N | YES | WV | 1152 |
| HUN | HUALIEN, TAIWAN | N | NO | -0- | 6508 |
| HYD | HYDERABAD, INDIA | N | NO | -0- | 2103 |
| IAD | DULLES INT'L, WASHINGTON, DC, USA | N | YES | DC | 84839 |
| IAH | HOUSTON INTERCONT, TX, USA | N | YES | TX | 35485 |
| IAM | IN AMENAS, ALGERIA | N | NO | -0- | 408 |
| IBA | IBADAN, NIGERIA | N | NO | -0- | 1382 |
| IBZ | IBIZA, SPAIN | N | NO | -0- | 124 |
| ICT | WICHITA, KA, USA | N | YES | KA | 10698 |
| IDA | IDAHO FALLS, ID, USA | N | YES | ID | 2190 |
| IDR | INDORE, INDIA | N | NO | -0- | 1460 |
| IFN | ISFAHAN, IRAN | N | NO | -0- | 2256 |
| IGL | IZMIR-CIGLI, TURKEY | N | NO | -0- | 26 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| IGR | IGUAZU, ARGENTINA | S | NO | -0- | 986 |
| IGU | IGUASSU FALLS, BRAZIL | S | NO | -0- | 1776 |
| ILG | PHILADELPHIA-WILMINGTON, PA, USA | N | YES | PA | 440 |
| ILM | WILMINGTON, NC, USA | N | YES | NC | 6254 |
| ILR | ILORIN, NIGERIA | N | NO | -0- | 1568 |
| IMF | IMPHAL, INDIA | N | NO | -0- | 1460 |
| IMP | IMPERATRIZ, BRAZIL | S | NO | -0- | 1186 |
| IND | INDIANAPOLIS, IN, USA | N | YES | IN | 12290 |
| INI | NIS, YUGOSLAVIA | N | NO | -0- | 57 |
| INU | NAURU, REP OF NAURU | S | NO | -0- | 889 |
| INZ | IN SALAH, ALGERIA | N | NO | -0- | 586 |
| IOA | IOANNINA, GREECE | N | NO | -0- | 1354 |
| IOS | ILHEUS, BRAZIL | S | NO | -0- | 2920 |
| IQQ | IQUIQUE, CHILE | S | NO | -0- | 1460 |
| IQT | IQUTOS, PERU | S | NO | -0- | 210 |
| IRJ | LA RIOJA, ARGENTINA | S | NO | -0- | 860 |
| IRP | ISIRO, ZAIRE | N | NO | -0- | 104 |
| ISA | MOUNT ISA, QLD, AUSTRALIA | S | NO | -0- | 546 |
| ISB | ISLAMABAD RAWALPINDI, PAKISTAN | N | NO | -0- | 3663 |
| ISG | ISHIGAKI, JAPAN | N | NO | -0- | 6936 |
| ISO | KINSTON, NC, USA | N | YES | NC | 2024 |
| ISP | LONG ISLAND MACARTHUR, NY, USA | N | YES | NY | 5816 |
| IST | ISTANBUL, TURKEY | N | NO | -0- | 2551 |
| ITH | ITHICA, NY, USA | N | YES | NY | 182 |
| ITO | HILO HAWAII, HA, US | N | NO | HA | 8568 |
| IUE | NIUE ISLAND, NIUE | S | NO | -0- | 127 |
| IVC | INVERCARGILL, NEW ZEALAND | S | NO | -0- | 2069 |
| IXA | AGARTALA, INDIA | N | NO | -0- | 1976 |
| IXB | BAGDOGRA, INDIA | N | NO | -0- | 2366 |
| IXC | CHANDIGAR, INDIA | N | NO | -0- | 1460 |
| IXD | ALLAHABAD, INDIA | N | NO | -0- | 392 |
| IXE | MANGALORE, INDIA | N | NO | -0- | 2370 |
| IXJ | JAMMU, INDIA | N | NO | -0- | 1650 |
| IXL | LEH, INDIA | N | NO | -0- | 574 |
| IXM | MADURAI, INDIA | N | NO | -0- | 1200 |
| IXR | RANCHI, INDIA | N | NO | -0- | 1460 |
| IXS | SILCHAR, INDIA | N | NO | -0- | 1748 |
| IXU | AURANGABAD, INDIA | N | NO | -0- | 1820 |
| IXZ | PORT BLAIR ANDAMAN ISLAND, INDIA | N | NO | -0- | 766 |
| JAC | JACKSON, WY, USA | N | YES | WY | 2325 |
| JAI | JAIPUR, INDIA | N | NO | -0- | 4068 |
| JAN | JACKSON, MS, USA | N | YES | MS | 3392 |
| JAX | JACKSONVILLE, FL, USA | N | YES | FL | 10211 |
| JDH | JODHPUR, INDIA | N | NO | -0- | 2920 |
| JDO | JUAZEIRO DO NORTE CEARAH, BRAZIL | S | NO | -0- | 626 |
| JED | JEDDAH, SAUDI ARABIA | N | NO | -0- | 19745 |
| JER | JERSEY CHANNEL ISLANDS, UK | N | NO | -0- | 1263 |
| JFK | KENNEDY, NEW YORK, NY, USA | N | YES | NY | 13217 |
| JGA | JAMNAGAR, INDIA | N | NO | -0- | 730 |
| JHB | JOHOR BAHRU, MALAYSIA | N | NO | -0- | 4018 |
| JIB | DJIBOUTI, DJIBOUTI | N | NO | -0- | 508 |
| JKH | CHIOS, GREECE | N | NO | -0- | 1858 |
| JNB | JOHANNESBURG, SOUTH AFRICA | S | NO | -0- | 13746 |
| JNU | JUNEAU, AS, US | N | NO | AS | 2255 |
| JOI | JOINVILLE, BRAZIL | S | NO | -0- | 626 |
| JOS | JOS, NIGERIA | N | NO | -0- | 2596 |
| JPA | JOAO PESSOA, BRAZIL | S | NO | -0- | 1460 |
| JRH | JORHAT, INDIA | N | NO | -0- | 694 |
| JRO | KILIMANJARO, TANZANIA | S | NO | -0- | 1667 |
| JSI | SKIATHOS, GREECE | N | NO | -0- | 412 |
| JTR | SANTORINI, THIRA ISLAND, GREECE | N | NO | -0- | 1126 |
| JUB | JUBA, SUDAN | N | NO | -0- | 38 |
| JUJ | JUJUY, ARGENTINA | S | NO | -0- | 600 |
| KAD | KADUNA, NIGERIA | N | NO | -0- | 3896 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| KAN | KANO, NIGERIA | N | NO | -0- | 700 |
| KBL | KABUL, AFGHANISTAN | N | NO | -0- | 208 |
| KBR | KOTA BHARU, MALAYSIA | N | NO | -0- | 3024 |
| KCH | KUCHING, SARAWAK, MALAYSIA | N | NO | -0- | 5337 |
| KCZ | KOCHI, JAPAN | N | NO | -0- | 1522 |
| KDU | SKARDU, PAKISTAN | N | NO | -0- | 190 |
| KEF | REYKJAVIK-KEFLAVIK, ICELAND | N | NO | -0- | 561 |
| KER | KERMAN, IRAN | N | NO | -0- | 532 |
| KGA | KANANGA, ZAIRE | S | NO | -0- | 420 |
| KGL | KIGALI, RWANDA | S | NO | -0- | 22 |
| KGS | KOS, GREECE | N | NO | -0- | 550 |
| KHH | KAOHSIUNG, TAIWAN | N | NO | -0- | 14596 |
| KHI | KARACHI, PAKISTAN | N | NO | -0- | 7384 |
| KHN | NANCHANG KIANGSI, P. R. CHINA | N | NO | -0- | 228 |
| KIJ | NIIGATA, JAPAN | N | NO | -0- | 2190 |
| KIM | KIMBERLEY, SOUTH AFRICA | S | NO | -0- | 3888 |
| KIN | KINGSTON, JAMAICA | N | NO | -0- | 338 |
| KKC | KHON KAEN, THAILAND | N | NO | -0- | 2264 |
| KLX | KALAMATA, GREECE | N | NO | -0- | 782 |
| KMG | KUNMING, P.R. CHINA | N | NO | -0- | 2448 |
| KMI | MIYAZAKI, JAPAN | N | NO | -0- | 4686 |
| KMP | KEETMANSHOOP, NAMIBIA | S | NO | -0- | 174 |
| KMQ | KOMATSU, JAPAN | N | NO | -0- | 730 |
| KND | KINDU, ZAIRE | S | NO | -0- | 480 |
| KNU | KANPUR, INDIA | N | NO | -0- | 1372 |
| KOA | KONA, HA, US | N | NO | HA | 11308 |
| KOJ | KAGOSHIMA, JAP/ ‹ | N | NO | -0- | 843 |
| KRS | KRISTIANSAND, .ORWAY | N | NO | -0- | 7646 |
| KRT | KHARTOUM, SUDAN | N | NO | -0- | 1921 |
| KSA | KOSRAE, CAROLINE ISLANDS | N | NO | -0- | 10 |
| KSM | ST MARY'S, AS, US | N | NO | AS | 420 |
| KST | KOSTI, SUDAN | N | NO | -0- | -0- |
| KSU | KRISTIANSUND, NORWAY | N | NO | -0- | 2128 |
| KTM | KATHMANDU, NEPAL | N | NO | -0- | 2240 |
| KTN | KETCHIKAN, AS, US | N | NO | AS | 1460 |
| KUA | KUANTAN, MALAYSIA | N | NO | -0- | 426 |
| KUH | KUSHIRO, JAPAN | N | NO | -0- | 1336 |
| KUL | KUALA LUMPUR, MALAYSIA | N | NO | -0- | 21147 |
| KVA | KAVALA, GREECE | N | NO | -0- | 1242 |
| KWE | GUIYANG, P. R. CHINA | N | NO | -0- | 684 |
| KWI | KUWAIT, KUWAIT | N | NO | -0- | 3659 |
| KWL | GUILIN, P. R. CHINA | N | NO | -0- | 3855 |
| LAD | LUANDA, ANGOLA | S | NO | -0- | 5680 |
| LAN | LANSING, MI, USA | N | YES | MI | 1120 |
| LAS | LAS VEGAS, NV, USA | N | YES | NV | 82033 |
| LAX | LOS ANGELES, CA, USA | N | YES | CA | 113329 |
| LBB | LUBBOCK, TX, USA | N | YES | TX | 13600 |
| LBU | LABUAN SABAH, MALAYSIA | N | NO | -0- | 2398 |
| LBV | LIBREVILLE, GABON | N | NO | -0- | 1553 |
| LCA | LARNACA, CYPRUS | N | NO | -0- | 1352 |
| LCE | LA CEIBA, HONDURAS | N | NO | -0- | 380 |
| LDE | LOURDES/TARBES, FRANCE | N | NO | -0- | 8 |
| LDI | LINDI, TANZANIA | S | NO | -0- | 10 |
| LED | LENINGRAD, U.S.S.R. | N | NO | -0- | 198 |
| LEI | ALMERIA, SPAIN | N | NO | -0- | 100 |
| LEJ | LEIPZIG, GDR | N | NO | -0- | 16 |
| LEX | LEXINGTON, KY, USA | N | YES | KY | 3916 |
| LFW | LOME, TOGO | N | NO | -0- | 985 |
| LGA | NEW YORK LA GUARDIA, NY, USA | N | YES | NY | 32068 |
| LGB | LONG BEACH, CA, USA | N | YES | CA | 1299 |
| LGW | LONDON-GATWICK, ENGLAND | N | NO | -0- | 13117 |
| LHE | LAHORE, PAKISTAN | N | NO | -0- | 7188 |
| LHR | LONDON HEATHROW, ENGLAND, (UK) | N | NO | -0- | 89405 |
| LIH | LIHUE, KAUAI, HA, US | N | NO | HA | 17365 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| LIL | LILLE, FRANCE | N | NO | -0- | 214 |
| LIM | LIMA, PERU | S | NO | -0- | 1460 |
| LIN | MILAN LINATE, ITALY | N | NO | -0- | 7588 |
| LIS | LISBON, PORTUGAL | N | NO | -0- | 10558 |
| LIT | LITTLE ROCK, AK, USA | N | YES | AK | 10791 |
| LJA | LODJA, ZAIRE | S | NO | -0- | 106 |
| LJU | LJUBLJANA, YUGOSLAVIA | N | NO | -0- | 1741 |
| LKO | LUCKNOW, INDIA | N | NO | -0- | 4396 |
| LLW | LILONGWE, MALAWI | S | NO | -0- | 752 |
| LMT | KLAMATH FALLS, OR, USA | N | YES | OR | 1218 |
| LNK | LINCOLN, NB, USA | N | YES | NB | 5816 |
| LNZ | LONZ, AUSTRIA | N | NO | -0- | 768 |
| LOS | LAGOS, NIGERIA | N | NO | -0- | 16716 |
| LPA | GRAN CANARIA, CANARY ISLANDS | N | NO | -0- | 293 |
| LPB | LA PAZ, BOLIVIA | S | NO | -0- | 136 |
| LPL | LIVERPOOL, ENGLAND | N | NO | -0- | 30 |
| LST | LAUNCESTON, TASMANIA, AUSTRALIA | S | NO | -0- | 4721 |
| LTN | LONDON-LUTON INT'L, ENGLAND | N | NO | -0- | 192 |
| LUN | LUSAKA, ZAMBIA | S | NO | -0- | 2302 |
| LUO | LUENA, ANGOLA | S | NO | -0- | 434 |
| LUQ | SAN LUIS, ARGENTINA | S | NO | -0- | 196 |
| LUX | LUXEMBOURG, LUXEMBOURG | N | NO | -0- | 2615 |
| LXR | LUXOR, ARAB REP OF EGYPT | N | NO | -0- | 2161 |
| LXS | LEMNOS, GREECE | N | NO | -0- | 1040 |
| LYH | LYNCHBURG, VA, USA | N | YES | VA | 1824 |
| LYP | FAISALABAD, PAKISTAN | N | NO | -0- | 790 |
| LYR | LONGYEARBYEN, NORWAY | N | NO | -0- | 14 |
| LYS | LYON, FRANCE | N | NO | -0- | 5223 |
| MAA | MADRAS, INDIA | N | NO | -0- | 7714 |
| MAB | MARABA, BRAZIL | S | NO | -0- | 470 |
| MAD | MADRID, SPAIN | N | NO | -0- | 6813 |
| MAF | MIDLAND ODESSA, TX, USA | N | YES | TX | 16021 |
| MAH | MAHON, MENORCA, SPAIN | N | NO | -0- | 84 |
| MAJ | MAJURO, MARSHALL ISLAND | N | NO | -0- | 92 |
| MAN | MANCHESTER, ENGLAND (UK) | N | NO | -0- | 5780 |
| MAO | MANAUS, BRAZIL | S | NO | -0- | 6627 |
| MBJ | MONTEGO BAY, JAMAICA | N | NO | -0- | 218 |
| MBS | SAGINAW, MI, USA | N | YES | MI | 794 |
| MBX | MARIBOR, YUGOSLAVIA | N | NO | -0- | 0 |
| MCI | KANSIS CITY, MO, USA | N | YES | MO | 26453 |
| MCO | ORLANDO-INT'L, FL, USA | N | YES | FL | 23551 |
| MCP | MACAPA, AMAPA, BRAZIL | N | NO | -0- | 1888 |
| MCT | MUSCAT, OMAN | N | NO | -0- | 4409 |
| MCY | MAROOCHYDORE, QLD, AUSTRALIA | S | NO | -0- | 104 |
| MCZ | MACEIO, ALAGOAS, BRAZIL | S | NO | -0- | 978 |
| MDE | MEDELLIN, COLOMBIA | N | NO | -0- | 312 |
| MDI | MAKURDI, NIGERIA | N | NO | -0- | 730 |
| MDK | MBANDAKA, ZAIRE | N | NO | -0- | 416 |
| MDQ | MAR DEL PLATA, ARGENTINA | S | NO | -0- | 2964 |
| MDT | HARRISBURG-OLMSTEAD ST, PA, USA | N | YES | PA | 3784 |
| MDW | CHICAGO-MIDWAY, IL, USA | N | YES | IL | 33077 |
| MDZ | MENDOZA, ARGENTINA | S | NO | -0- | 1578 |
| MED | MEDINA, SAUDI ARABIA | N | NO | -0- | 4698 |
| MEG | MALANGE, ANGOLA | S | NO | -0- | 740 |
| MEL | MELBOURNE, VICTORIA, AUSTRALIA | S | NO | -0- | 17124 |
| MEM | MEMPHIS, TN, USA | N | YES | TN | 8599 |
| MES | MEDAN, INDONESIA | N | NO | -0- | 730 |
| MEX | MEXICO CITY, MEXICO | N | NO | -0- | 4170 |
| MFE | MC ALLEN, TX, USA | N | YES | TX | 288 |
| MFR | MEDFOR, OR, USA | N | YES | OR | 3529 |
| MFU | MFUWE, ZAMBIA | S | NO | -0- | 34 |
| MGA | MANAGUA, NICARAGUA | N | NO | -0- | 3212 |
| MGM | MONTGOMERY, AL, USA | N | YES | AL | 148 |
| MGQ | MOGADISHU, SOMALIA | N | NO | -0- | 94 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| MHD | MASHAD, IRAN | N | NO | -0- | 516 |
| MIA | MIAMI, FL, USA | N | YES | FL | 28033 |
| MIL | MILAN, ITALY | N | NO | -0- | -0- |
| MIR | MONASTIR, TUNISIA | N | NO | -0- | 488 |
| MIU | MAIDUGURI, NIGERIA | N | NO | -0- | 887 |
| MJM | MBUJI-MAYI, ZAIRE | S | NO | -0- | 364 |
| MJN | MAJUNGA, MADAGASCAR | S | NO | -0- | 402 |
| MJT | MYTILENE, GREECE | N | NO | -0- | 2852 |
| MKE | MILWAUKEE, WI, USA | N | YES | WI | 1056 |
| MKY | MALACCA, MALAYSIA | S | NO | -0- | 2109 |
| MLA | MALTA, MEDITERRANEAN SEA | N | NO | -0- | 2882 |
| MLB | MELBOURNE, FL, USA | N | YES | FL | 958 |
| MLE | MALE, MALDIVES | N | NO | -0- | 356 |
| MLH | MULHOUSE/BASEL, FRANCE | N | NO | -0- | 1 |
| MLI | MOLINE, IL, USA | N | YES | IL | 1947 |
| MLU | MONROE, LA, USA | N | YES | LA | 3670 |
| MMY | MIYAKO JIMA, JAPAN | N | NO | -0- | 3606 |
| MNL | MANILA, PHILIPPINES | N | NO | -0- | 1232 |
| MOB | MOBILE AL/PASCAGOULA, MS, USA | N | YES | AL | 3013 |
| MOC | MONTES CLAROS, BRAZIL | S | NO | -0- | 416 |
| MOL | MOLDE, NORWAY | N | NO | -0- | 2129 |
| MOQ | MORONDAVA, MADAGASCAR | S | NO | -0- | 112 |
| MOT | MINOT, ND, USA | N | YES | ND | 737 |
| MPL | MONTPELLIER, FRANCE | N | NO | -0- | 52 |
| MPM | MAPUTO, MOZAMBIQUE | S | NO | -0- | 2248 |
| MRS | MARSEILLE, FRANCE | N | NO | -0- | 3381 |
| MRU | MAURITIUS, MAURITIUS | S | NO | -0- | 321 |
| MRY | MONTEREY, CA, USA | N | YES | CA | 3559 |
| MSN | MADISON, WI, USA | N | YES | WI | 1695 |
| MSO | MISSOULA, MT, USA | N | YES | MT | 3537 |
| MSP | MINNEAPOLIS-ST PAUL, MN, USA | N | YES | MN | 8120 |
| MSR | MUENSTER, FRG | N | NO | -0- | 4 |
| MSY | NEW ORLEANS, LA, USA | N | YES | LA | 25950 |
| MSZ | NAMIBE, ANGOLA | S | NO | -0- | 228 |
| MTS | MANZINI, SWAZILAND | S | NO | -0- | 96 |
| MTY | MONTERREY, MEXICO | N | NO | -0- | 0 |
| MUC | MUNICH, FRG | N | NO | -0- | 36435 |
| MUX | MULTAN, PAKISTAN | N | NO | -0- | 2488 |
| MUZ | MUSOMA, TANZANIA | S | NO | -0- | 8 |
| MVB | FRANCEVILLE, GABON | N | NO | -0- | 1 |
| MVD | MONTEVIDEO, URUGUAY | S | NO | -0- | 4977 |
| MVR | MAROUA, REP OF CAMEROON | N | NO | -0- | 1190 |
| MWZ | MWANZA, TANZANIA | S | NO | -0- | 79 |
| MXP | MILAN-MALPENSA, ITALY | N | NO | -0- | 4 |
| MYJ | MATSUYAMA, SHIKIKU, JAPAN | N | NO | -0- | 290 |
| MYR | MYRTLE BEACH, SC, USA | N | YES | SC | 4864 |
| MYW | MTWARA, TANZANIA | S | NO | -0- | 370 |
| MYY | MIRI, SARAWAK, MALAYSIA | N | NO | -0- | 3024 |
| MZG | MAKUNG, TAIWAN | N | NO | -0- | 8877 |
| MZT | MAZATLAN, MEXICO | N | NO | -0- | 976 |
| NAG | NAGPUR, INDIA | N | NO | -0- | 2756 |
| NAN | NADI, FIJI | S | NO | -0- | 1373 |
| NAP | NAPLES, ITALY | N | NO | -0- | 739 |
| NAS | NASSAU, BAHAMAS | N | NO | -0- | 7440 |
| NAT | NATAL, BRAZIL | S | NO | -0- | 4380 |
| NBO | NAIROBI, KENYA | S | NO | -0- | 1651 |
| NCE | NICE, FRANCE | N | NO | -0- | 3675 |
| NCL | NEWCASTLE, ENGLAND | N | NO | -0- | 1825 |
| NDD | SUMBE, ANGOLA | S | NO | -0- | 10 |
| NDJ | N'DJAMENA, CHAD | N | NO | -0- | 18 |
| NGE | N'GAOUNDERE, REP OF CAMEROON | N | NO | -0- | 1006 |
| NGO | NAGOYA, JAPAN | N | NO | -0- | 5577 |
| NIM | NIAMEY, NIGER | N | NO | -0- | 82 |
| NKC | NOUAKCHOTT, MAURITANIA | N | NO | -0- | 110 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| NKG | NANJING, P. R. CHINA | N | NO | -0- | 2476 |
| NLA | NDOLA, ZAMBIA | S | NO | -0- | 701 |
| NLK | NORFOLK ISLAND, PACIFIC OCEAN | S | NO | -0- | 420 |
| NNG | NANNING, P. R. CHINA | N | NO | -0- | 1157 |
| NOS | NOSSIBE, MADAGASCAR | S | NO | -0- | 508 |
| NOU | NOUMEA, NEW CALEDONIA | S | NO | -0- | 219 |
| NOV | HUAMBO, ANGOLA | S | NO | -0- | 520 |
| NQN | NEUQUEN, ARGENTINA | S | NO | -0- | 1876 |
| NUE | NUREMBURG, FRG | N | NO | -0- | 3516 |
| NVT | NAVEGANTES, BRAZIL | S | NO | -0- | 2606 |
| OAJ | JACKSONVILLE, NC, USA | N | YES | NC | 2428 |
| OAK | OAKLAND, SAN FRANCISCO, CA, USA | N | YES | CA | 27453 |
| ODE | ODENSE, DENMARK | N | NO | -0- | 567 |
| OGG | KAHULUI, MAUI, HA, US | N | NO | HA | 27942 |
| OGX | OUARGLA, ALGERIA | N | NO | -0- | 836 |
| OHD | OHRID, YUGOSLAVIA | N | NO | -0- | 292 |
| OIT | OITA, JAPAN | N | NO | -0- | 854 |
| OKA | OKINAWA, RYUKYU IS, JAPAN | N | NO | -0- | 11818 |
| OKC | OKLAHOMA CITY, OK, USA | N | YES | OK | 25165 |
| OLB | OLBIA, ITALY | N | NO | -0- | 40 |
| OMA | OMAHA, NB, USA | N | YES | NB | 10800 |
| OME | NOME, AS, US | N | NO | AS | 2272 |
| ONT | ONTARIO, CA, USA | N | YES | CA | 33033 |
| OOL | GOLD COAST, QLD, AUSTRALIA | S | NO | -0- | 2812 |
| OPO | OPORTO, PORTUGAL | N | NO | -0- | 3349 |
| ORD | CHICAGO-O'HARE, IL, USA | N | YES | IL | 59542 |
| ORF | NORFOLK-VA. BEACH, VA, USA | N | YES | VA | 24618 |
| ORH | WORCESTER, MA, USA | N | YES | MA | 719 |
| ORK | CORK, IRELAND | N | NO | -0- | 2942 |
| ORN | ORAN, ALGERIA | N | NO | -0- | 4524 |
| ORY | PARIS - ORLY ARPT, FRANCE | N | NO | -0- | 6940 |
| OSA | OSAKA, JAPAN | N | NO | -0- | 1792 |
| OSL | OSLO, NORWAY | N | NO | -0- | 14168 |
| OSM | MOSUL, IRAQ | N | NO | -0- | 312 |
| OTP | BUCHAREST-OTOPENI, ROMANIA | N | NO | -0- | 487 |
| OTZ | KOTZEBUE, AS, US | N | NO | AS | 2082 |
| OUA | OUAGADOUGOU, BURKINA FASO | N | NO | -0- | 14 |
| OUD | OUJDA, MOROCCO | N | NO | -0- | 402 |
| OUE | OUESSO, PEOP REP OF CONGO | N | NO | -0- | 258 |
| OZZ | OUARAZATE, MOROCCO | N | NO | -0- | 161 |
| PAT | PATNA, INDIA | N | NO | -0- | 4973 |
| PBI | WEST PALM BEACH, FL, USA | N | YES | FL | 10310 |
| PBM | PARAMARIBO, REP OF SURINAME | N | NO | -0- | 104 |
| PCL | PUCALLPA, PERU | S | NO | -0- | 586 |
| PDL | PONTA DELGADA, PORTUGAL (AZORES) | N | NO | -0- | 886 |
| PDP | PUNTA DEL ESTE, URUGUAY | S | NO | -0- | 2332 |
| PDX | PORTLAND, OR, USA | N | YES | OR | 18968 |
| PEK | BEIJIN, P. R. CHINA | N | NO | -0- | 9169 |
| PEN | PENANG, MALAYSIA | N | NO | -0- | 9062 |
| PER | PERTH, WA, AUSTRALIA | S | NO | -0- | 1178 |
| PEW | PESHAWAR, PAKISTAN | N | NO | -0- | 418 |
| PHC | PORT HARCOURT, NIGERIA | N | NO | -0- | 208 |
| PHE | PORT HEDLAND, WA, AUSTRALIA | S | NO | -0- | 130 |
| PHL | PHILADELPHIA/WILMINGTON, PA, USA | N | YES | PA | 34184 |
| PHS | PHITSANULOK, THAILAND | N | NO | -0- | 1460 |
| PHX | PHOENIX, AZ, USA | N | YES | AZ | 163588 |
| PIA | PEORIA, IL, USA | N | YES | IL | 389 |
| PIE | TAMPA-ST. PETERSBURG, FL, USA | N | YES | FL | 302 |
| PIK | GLASGOW-PRESTWICK, SCOTLAND | N | NO | -0- | 52 |
| PIT | PITTSBURGH, PA, USA | N | YES | PA | 69413 |
| PIU | PIURA, PERU | S | NO | -0- | 1068 |
| PLZ | PORT ELIZABETH, SOUTH AFRICA | S | NO | -0- | 12531 |
| PMA | PEMBA ISLAND, TANZANIA | S | NO | -0- | 8 |
| PMC | PUERTO MONTT, CHILE | S | NO | -0- | 1400 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| PME | PORTSMOUTH, UK | N | NO | -0- | -0- |
| PMI | PALMA MALLORCA ISLAND, SPAIN | N | NO | -0- | 2449 |
| PMR | PALMERSTON, NEW ZEALAND | S | NO | -0- | 2592 |
| PNQ | POONA, INDIA | N | NO | -0- | 842 |
| PNR | POINTE NOIRE, PEOP REP OF CONGO | S | NO | -0- | 1265 |
| PNS | PENSACOLA, FL, USA | N | YES | FL | 2180 |
| PNZ | PETROLINA, BRAZIL | S | NO | -0- | 720 |
| POA | PORTO ALEGRE, BRAZIL | S | NO | -0- | 8156 |
| POG | PORT GENTIL, GABON | S | NO | -0- | 18 |
| POL | PEMBA, MOZAMBIQUE | S | NO | -0- | 260 |
| POS | PORT OF SPAIN, TRINIDAD/TOBAGO | N | NO | -0- | 52 |
| PPG | PAGO PAGO, SAMOA | S | NO | -0- | 434 |
| PPP | PROSERPINE, QLD, AUSTRALIA | S | NO | -0- | 437 |
| PRG | PRAGUE, CZECHOSLOVAKIA | N | NO | -0- | 1231 |
| PSA | PISA, ITALY | N | NO | -0- | 1082 |
| PSC | PASCO, WA, USA | N | YES | WA | 864 |
| PSG | PETERSBURG, AS, US | N | NO | AS | 1460 |
| PSI | PASNI, PAKISTAN | N | NO | -0- | 208 |
| PSP | PALM SPRINGS, CA, USA | N | YES | CA | 3083 |
| PSS | POSADAG, ARGENTINA | S | NO | -0- | 938 |
| PTY | PANAMA CITY, PANAMA | N | NO | -0- | 2683 |
| PUB | PUEBLO, CO, USA | N | YES | CO | 2569 |
| PUQ | PUNTA ARENAS, CHILE | S | NO | -0- | 760 |
| PUY | PULA, YUGOSLAVIA | N | NO | -0- | 76 |
| PVD | PROVIDENCE, RI, USA | N | YES | RI | 5358 |
| PVH | PORTO VELHO, BRAZIL | S | NO | -0- | 4700 |
| PVR | PUERTO VALLARTA, MEXICO | N | NO | -0- | 880 |
| PWM | PORTLAND, ME, USA | N | YES | ME | 2450 |
| PXO | PORTO SANTO, PORTUGAL (MADEIRA) | N | NO | -0- | 58 |
| PZU | PORT SUDAN, SUDAN | N | NO | -0- | 925 |
| QTV | TREVISO, ITALY | N | NO | -0- | -0- |
| RAE | ARAR, SAUDI ARABIA | N | NO | -0- | 1682 |
| RAH | RAFHA, SAUDI ARABIA | N | NO | -0- | 166 |
| RAJ | RAJKOT, INDIA | N | NO | -0- | 730 |
| RAK | MARRAKECH, MOROCCO | N | NO | -0- | 529 |
| RAP | RAPID CITY, SD, USA | N | YES | SD | 4703 |
| RAR | RAROTONGA, COOK ISLAND, S. PACIFIC | S | NO | -0- | 152 |
| RAS | RASHT, IRAN | N | NO | -0- | 540 |
| RBR | RIO BRANCO, BRAZIL | S | NO | -0- | 3614 |
| RCU | RIO CUARTO, ARGENTINA | S | NO | -0- | 552 |
| RDD | REDDING, CA, USA | N | YES | CA | 3151 |
| RDU | RALEIGH-DURHAM, NC, USA | N | YES | NC | 23607 |
| REC | RECIFE, BRAZIL | S | NO | -0- | 8974 |
| REL | TRELEW, ARGENTINA | S | NO | -0- | 2448 |
| RES | RESISTENCIA, ARGENTINA | S | NO | -0- | 730 |
| RGA | RIO GRANDE, ARGENTINA | S | NO | -0- | 1628 |
| RGL | RIO GALLEGOS, ARGENTINA | S | NO | -0- | 3170 |
| RHO | RHODES, GREECE | N | NO | -0- | 728 |
| RIC | RICHMOND, VA, USA | N | YES | VA | 8252 |
| RIJ | RIOJA, PERU | S | NO | -0- | 338 |
| RIY | RIYAN, YEMEN | N | NO | -0- | 560 |
| RJK | RIJEKA, YUGOSLAVIA | N | NO | -0- | 76 |
| RKT | RAS AL KHAIMAH, U. A. EMIRATES | N | NO | -0- | 236 |
| RNN | RONNE, DENMARK | N | NO | -0- | 298 |
| RNO | RENO, NV, USA | N | YES | NV | 25150 |
| ROA | ROANOKE, VA, USA | N | YES | VA | 3910 |
| ROB | MONROVIA ROBERTS, LIBERIA | N | NO | -0- | 320 |
| ROC | ROCHESTER, NY, USA | N | YES | NY | 13533 |
| ROK | ROCKHAMPTON, QLD, AUSTRALIA | S | NO | -0- | 3570 |
| ROR | KOROR, PALAU ISLAND, PACIFIC OCEAN | N | NO | -0- | 132 |
| ROS | ROSARIO, ARGENTINA | S | NO | -0- | 1704 |
| RPR | RAIPUR, INDIA | N | NO | -0- | 1460 |
| RRS | ROROS, NORWAY | N | NO | -0- | 782 |
| RSW | FORT MYERS REGIONAL, FL, USA | N | YES | FL | 2486 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| RUH | RIYADH, SAUDI ARABIA | N | NO | -0- | 21799 |
| RUN | REUNION ISLAND, INDIAN OCEAN | S | NO | -0- | 436 |
| SAB | SABA, NETH. ANTILLES | N | NO | -0- | -0- |
| SAH | SANAA, YEMEN | N | NO | -0- | 1580 |
| SAL | SAN SALVADOR, EL SALVADOR | N | NO | -0- | 6574 |
| SAN | SAN DIEGO, CA, USA | N | YES | CA | 36109 |
| SAO | SAO PAULO, BRAZIL | S | NO | -0- | -0- |
| SAP | SAN PEDRO, SULA, HONDURAS | N | NO | -0- | 3411 |
| SAT | SAN ANTONIO, TX, USA | N | YES | TX | 31907 |
| SAV | SAVANNAH, GA, USA | N | YES | GA | 5077 |
| SBA | SANTA BARBARA, CA, USA | N | YES | CA | 2895 |
| SBN | SOUTH BEND, IN, USA | N | YES | IN | 1496 |
| SCC | PRUDHOE BAY, DEADHORSE, AS, US | N | NO | AS | 3834 |
| SCK | STOCKTON,CA, USA | N | YES | CA | 787 |
| SCL | SANTIAGO, CHILE | S | NO | -0- | 3733 |
| SCN | SAARBRUECKEN, FRG | N | NO | -0- | -0- |
| SDA | BAGHDAD-SADDAM, IRAQ | N | NO | -0- | 2599 |
| SDD | LUBANGO, ANGOLA | S | NO | -0- | 862 |
| SDE | SANTIAGO DEL ESTERO, ARGENTINA | S | NO | -0- | 910 |
| SDF | LOUISVILLE, KY, USA | N | YES | KY | 11936 |
| SDJ | SENDAI, JAPAN | N | NO | -0- | 2796 |
| SDK | SANDAKAN, SABAH, MALAYSIA | N | NO | -0- | 2190 |
| SEA | SEATTLE/TACOMA, WA, USA | N | YES | WA | 27059 |
| SFA | SFAX, TUNISIA | N | NO | -0- | 186 |
| SFN | SANTA FE, ARGENTINA | S | NO | -0- | 624 |
| SFO | SAN FRANCISCO-OAKLAND, CA, USA | N | YES | CA | 82466 |
| SGF | SPRINGFIELD, MO, USA | N | YES | MO | 3704 |
| SHA | SHANGHAI, P. R. CHINA | N | NO | -0- | 1678 |
| SHE | SHENYANG, P. R. CHINA | N | NO | -0- | 206 |
| SHJ | SHARJAH, U. A. EMIRATES | N | NO | -0- | 2586 |
| SHV | SHREVEPORT, LA, USA | N | YES | LA | 3098 |
| SHW | SHARURAH, SAUDI ARABIA | N | NO | -0- | 730 |
| SIA | XI AN, P. R. CHINA | N | NO | -0- | 848 |
| SID | SAL, CAPE VERDE ISLAND | N | NO | -0- | 10 |
| SIN | SINGAPORE, SINGAPORE | N | NO | -0- | 6631 |
| SIT | SITKA, AS, US | N | NO | AS | 778 |
| SJC | SAN JOSE, CA, USA | N | YES | CA | 37310 |
| SJJ | SARAJEVO, YUGOSLAVIA | N | NO | -0- | 174 |
| SJO | SAN JOSE, COST RICA | N | NO | -0- | 3317 |
| SKG | THESSALONIKI, GREECE | N | NO | -0- | 1987 |
| SKO | SOKOTO, NIGERIA | N | NO | -0- | 1182 |
| SKP | SKOPJE, YUGOSLAVIA | N | NO | -0- | 210 |
| SKS | SKRYDSTRUP, DENMARK | N | NO | -0- | 45 |
| SKZ | SUKKUR, PAKISTAN | N | NO | -0- | 566 |
| SLA | SALTA, ARGENTINA | S | NO | -0- | 1934 |
| SLC | SALT LAKE CITY, UT, USA | N | YES | UT | 77961 |
| SLL | SALALAH, OMAN | N | NO | -0- | 882 |
| SLZ | SAO LUIZ, MARANHAO, BRAZIL | S | NO | -0- | 3629 |
| SMF | SACRAMENTO, CA, USA | N | YES | CA | 18876 |
| SMI | SAMOS ISLAND, GREECE | N | NO | -0- | 1678 |
| SNA | ORANGE COUNTY, CA, USA | N | YES | CA | 24680 |
| SNN | SHANNON, IRELAND | N | NO | -0- | 1999 |
| SNO | SAKON NAKHON, THAILAND | N | NO | -0- | 566 |
| SOF | SOFIA, BULGARIA | N | NO | -0- | 671 |
| SPP | MENONGUE, ANGOLA | S | NO | -0- | 224 |
| SPU | SPLIT, YUGOSLAVIA | N | NO | -0- | 1592 |
| SRQ | SARASOTA/BRADENTON, FL, USA | N | YES | FL | 657 |
| SSA | SALVADOR, BRAZIL | S | NO | -0- | 9230 |
| SSG | MALABO, EQUATORIAL GUINEA | N | NO | -0- | 126 |
| STL | ST LOUIS, MO, USA | N | YES | MO | 20660 |
| STM | SANTAREM, BRAZIL | S | NO | -0- | 3318 |
| STR | STUTTGART, FRG | N | NO | -0- | 18747 |
| STT | ST THOMAS, VIRGIN ISLANDS | N | NO | -0- | 740 |
| STV | SURAT, INDIA | N | NO | -0- | -0- |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| STX | ST CROIX, VIRGIN ISLANDS | N | NO | -0- | 730 |
| SUV | SUVA, FIJI | S | NO | -0- | 650 |
| SUX | SIOUX CITY, IO, USA | N | YES | IO | 1536 |
| SVB | SAMBAVA, MADAGASCAR | S | NO | -0- | 274 |
| SVG | STAVANGER, NORWAY | N | NO | -0- | 16946 |
| SVO | MOSCOW-SHEREMETYE, U.S.S.R. | N | NO | -0- | 864 |
| SVP | KUITO, ANGOLA | S | NO | -0- | 422 |
| SXB | STRASBOURG, FRANCE | N | NO | -0- | 76 |
| SXF | BERLIN, GDR | N | NO | -0- | 86 |
| SXR | SRINAGAR, INDIA | N | NO | -0- | 2123 |
| SYD | SYDNEY, N.S.W., AUSTRALIA | S | NO | -0- | 16325 |
| SYR | SYRACUSE, NY, USA | N | YES | NY | 10961 |
| SYZ | SHIRAZ, IRAN | N | NO | -0- | 3868 |
| SZG | SALZBURG, AUSTRIA | N | NO | -0- | 648 |
| TAI | TAIZ, YEMEN | N | NO | -0- | 820 |
| TBO | TABORA, TANZANIA | S | NO | -0- | 36 |
| TBP | TUMBES, PERU | S | NO | -0- | 404 |
| TBT | TABATINGA, BRAZIL | S | NO | -0- | 764 |
| TBU | TONGATAPU, TONGA ISLAND, PACIFIC | S | NO | -0- | 667 |
| TBZ | TABRIZ, IRAN | N | NO | -0- | 214 |
| TEE | TBESSA, ALGERIA | N | NO | -0- | 652 |
| TER | TERCEIRA, PORTUGAL (AZORES) | N | NO | -0- | 87 |
| TET | TETE, MOZAMBIQUE | S | NO | -0- | 364 |
| TEZ | TEZPUR, INDIA | N | NO | -0- | 728 |
| TFF | TEFE, BRAZIL | S | NO | -0- | 246 |
| TFS | TENERIFFE-REINASOFIA, CANARY ISLAND | N | NO | -0- | 244 |
| TGD | TITOGRAD, YUGOSLAVIA | N | NO | -0- | 616 |
| TGG | KUALA, TERENGGANU, MALAYSIA | N | NO | -0- | 438 |
| TGT | TANGA, TANZANIA | S | NO | -0- | 26 |
| TGU | TEGUCIGALPA, HONDURAS | N | NO | -0- | 3746 |
| THE | TERESINA, PIAUI, BRAZIL | S | NO | -0- | 2920 |
| THR | TEHRAN, IRAN | N | NO | -0- | 4370 |
| TIA | TIRANA, ALBANIA | N | NO | -0- | 104 |
| TIF | TAIF, SAUDI ARABIA | N | NO | -0- | 1484 |
| TIN | TINDOUF, ALGERIA | N | NO | -0- | 1006 |
| TIP | TRIPOLI, LIBYA | N | NO | -0- | 287 |
| TIV | TIVAT, YUGOSLAVIA | N | NO | -0- | 188 |
| TKQ | KIGOMA, TANZANIA | S | NO | -0- | 18 |
| TLE | TULEAR, MADAGASCAR | S | NO | -0- | 490 |
| TLH | TALLAHASSEE, FL, USA | N | YES | FL | 0 |
| TLM | TILIMSEN, ALGERIA | N | NO | -0- | 1046 |
| TLS | TOULOUSE, FRANCE | N | NO | -0- | 1152 |
| TLV | TEL AVIV-YAFO, ISRAEL | N | NO | -0- | 2334 |
| TMM | TAMATAVE, MADAGASCAR | S | NO | -0- | 150 |
| TMR | TAMANRASSET, ALGERIA | N | NO | -0- | 1228 |
| TMS | SAO TOME ISLAND, SAO TOME ISLAND | N | NO | -0- | 124 |
| TNG | TANGIER, MOROCCO | N | NO | -0- | 2117 |
| TNN | TAINAN, TAIWAN | N | NO | -0- | 3324 |
| TNR | ANTANANARIVO, MADAGASCAR | S | NO | -0- | 1953 |
| TOE | TOZEUR, TUNISIA | N | NO | -0- | 86 |
| TOL | TOLEDO, OH, USA | N | YES | OH | 1724 |
| TOS | TROMSO, NORWAY | N | NO | -0- | 2080 |
| TOY | TOYAMA, JAPAN | N | NO | -0- | 1522 |
| TPA | TAMPA/ST PETERSBURG, FL, USA | N | YES | FL | 19425 |
| TPP | TARAPOTO, PERU | S | NO | -0- | 656 |
| TRD | TRONDHEIM, NORWAY | N | NO | -0- | 11039 |
| TRI | TRI-CITY AIRPORT, TN, USA | N | YES | TN | 2166 |
| TRN | TURIN, ITALY | N | NO | -0- | 932 |
| TRU | TRUJILLO, PERU | S | NO | -0- | 28 |
| TRV | TRIVANDRUM, INDIA | N | NO | -0- | 2374 |
| TRW | TARAWA, REP OF KIRIBATI | N | NO | -0- | 106 |
| TRZ | TIRUCHIRAPALLY, INDIA | N | NO | -0- | 2318 |
| TSA | TAIPEI-SUNG SHAN, T[illegible]AN | N | NO | -0- | 22439 |
| TSN | TIANJIN, P. R. CHIN[illegible] | N | NO | -0- | 954 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| TSV | TOWNSVILLE, QLD, AUSTRALIA | S | NO | -0- | 6252 |
| TTJ | TOTTORI, JAPAN | N | NO | -0- | 1460 |
| TTT | TAITUNG, TAIWAN | N | NO | -0- | 1488 |
| TUC | TUCUMAN, ARGENTINA | S | NO | -0- | 2400 |
| TUL | TULSA, OK, USA | N | YES | OK | 30215 |
| TUN | TUNIS, TUNISIA | N | NO | -0- | 5129 |
| TUR | TUCURUI, BRAZIL | S | NO | -0- | 419 |
| TUS | TUCSON, AZ, USA | N | YES | AZ | 14844 |
| TUU | TABUK, SAUDI ARABIA | N | NO | -0- | 4152 |
| TVL | LAKE TAHOE, CA, USA | N | YES | CA | 2274 |
| TWU | TAWAU, SABAH, MALAYSIA | N | NO | -0- | 2920 |
| TXL | WEST BERLIN, GERMANY | N | NO | -0- | 17484 |
| TYL | TALARA, PERU | S | NO | -0- | 12 |
| TYN | TAIYUAN, P. R. CHINA | N | NO | -0- | 104 |
| TYS | KNOXVILLE, TN, USA | N | YES | TN | 4917 |
| UAQ | SAN JUAN, ARGENTINA | S | NO | -0- | 546 |
| UBA | UBERABA, BRAZIL | S | NO | -0- | 1186 |
| UBJ | UBE, JAPAN | N | NO | -0- | 2496 |
| UBP | UBON PATCHATHANI, THAILAND | N | NO | -0- | 730 |
| UDI | UBERLANDIA, BRAZIL | S | NO | -0- | 1186 |
| UDR | UDAIPUR, INDIA | N | NO | -0- | 1460 |
| UEL | QUELIMANE, MOZAMBIQUE | S | NO | -0- | 418 |
| UET | QUETTA, PAKISTAN | N | NO | -0- | 832 |
| UIO | QUITO, ECUADOR | S | NO | -0- | 1609 |
| UNK | UNALAKLEET, AS, US | N | NO | AS | 4 |
| URT | SURAT THANI, THAILAND | N | NO | -0- | 798 |
| URY | GURAYAT, SAUDI ARABIA | N | NO | -0- | 740 |
| USH | USHUAIA, ARGENTINA | S | NO | -0- | 1804 |
| UTH | UDON, THANI, THAILAND | N | NO | -0- | 738 |
| UTN | UPINGTON, SOUTH AFRICA | S | NO | -0- | 882 |
| UVL | NEW VALLEY, ARAB REP OF EGYPT | N | NO | -0- | 315 |
| VCE | VALVERDE, CANARY ISLANDS | N | NO | -0- | 1729 |
| VCP | SAO PAULO - VIRACOPOS, BRAZIL | S | NO | -0- | 104 |
| VDM | VIEDMA, ARGENTINA | S | NO | -0- | 416 |
| VFA | VICTORIA FALL, ZIMBABWE | S | NO | -0- | 610 |
| VHC | SAURIMO, ANGOLA | S | NO | -0- | 252 |
| VIE | VIENNA, AUSTRIA | N | NO | -0- | 5820 |
| VIL | DAKHLA, MOROCCO | N | NO | -0- | 8 |
| VIX | VITORIA, ESPIRITO SANTO, BRAZIL | S | NO | -0- | 2878 |
| VLC | VALENCIA, SPAIN | N | NO | -0- | 206 |
| VLG | VILLA GESELL, ARGENTINA | S | NO | -0- | 154 |
| VLI | PORT VILA, VANUATU | S | NO | -0- | 251 |
| VNS | VARANASI, INDIA | N | NO | -0- | 3150 |
| VTZ | VISHAKHAPATNAM, INDIA | N | NO | -0- | 1722 |
| VVI | SANTA CRUZ, VIRU VIRU, BOLIVIA | S | NO | -0- | 104 |
| VXC | LICHINGA, MOZAMBIQUE | S | NO | -0- | 312 |
| WAW | WARSAW, POLAND | N | NO | -0- | 1027 |
| WDH | WINDHOEK, NAMIBIA | S | NO | -0- | 1862 |
| WLG | WELLINGTON, NEW ZEALAND | S | NO | -0- | 17828 |
| WRG | WRANGELL, AS, US | N | NO | AS | 1460 |
| WUH | WUHAN, P. R. CHINA | N | NO | -0- | 2002 |
| XMN | XIAMEN, P. R. CHINA | N | NO | -0- | 2254 |
| XRY | JEREZ DE LA FRONTERA, SPAIN | N | NO | -0- | -0- |
| YAK | YAKUTAT, AS, US | N | NO | AS | 1460 |
| YAM | SAULT STE MARIE, ONT., CANADA | N | NO | -0- | 3540 |
| YAO | YAOUNDE, REP OF CAMEROON | N | NO | -0- | 4147 |
| YBC | BAIE COMEAU, QUEBEC, CANADA | N | NO | -0- | 276 |
| YBG | SAGUENAY, QUE, CANADA | N | NO | -0- | 520 |
| YBR | BRANDON, MAN, CANADA | N | NO | -0- | 1252 |
| YCB | CAMBRIDGE BAY, NWT, CANADA | N | NO | -0- | 239 |
| YCG | CASTLEGAR, BC, CANADA | N | NO | -0- | 626 |
| YCH | CHATHAM, NB, CANADA | N | NO | -0- | 626 |
| YCL | CHARLO, NB, CANADA | N | NO | -0- | 626 |
| YDF | DEER LAKE, NFLD, CANADA | N | NO | -0- | 2855 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| YDQ | DAWSON CREEK, BC, CANADA | N | NO | -0- | 626 |
| YEG | EDMONTON, ALTA, CANADA | N | NO | -0- | 11693 |
| YEV | INUVIK, NWT, CANADA | N | NO | -0- | 745 |
| YFB | IQALIUT, NWT, CANADA | N | NO | -0- | 1769 |
| YFC | FREDERICTON, NB, CANADA | N | NO | -0- | 1342 |
| YFO | FLIN FLON, MAN, CANADA | N | NO | -0- | 420 |
| YGJ | YONAGO, JAPAN | N | NO | -0- | 2190 |
| YGL | LA GRANDE, QUE, CANADA | N | NO | -0- | 1044 |
| YGW | KUUJJUARAPIK, QUE, CANADA | N | NO | -0- | 522 |
| YGX | GILLAM, MAN, CANADA | N | NO | -0- | 832 |
| YHD | DRYDEN, ONT, CANADA | N | NO | -0- | 2699 |
| YHY | HAY RIVER, NWT, CANADA | N | NO | -0- | 1252 |
| YHZ | HALIFAX, NS, CANADA | N | NO | -0- | 14221 |
| YJT | STEPHENVILLE, NFLD, CANADA | N | NO | -0- | 144 |
| YKA | KAMLOOPS, BC, CANADA | N | NO | -0- | 2650 |
| YLW | KELOWNA, BC, CANADA | N | NO | -0- | 8790 |
| YMM | FT MCMURRAY, ALTA, CANADA | N | NO | -0- | 1148 |
| YMS | YURIMAGUAS, PERU | S | NO | -0- | 210 |
| YMX | MONTREAL MIRABEL, QUE, CANADA | N | NO | -0- | 569 |
| YNB | YANBU, SAUDI ARABIA | N | NO | -0- | 2513 |
| YNG | YOUNGSTOWN, OH, USA | N | YES | OH | 330 |
| YOL | YOLA, NIGERIA | N | NO | -0- | 1279 |
| YOW | OTTAWA, ONT, CANADA | N | NO | -0- | 10695 |
| YPR | PRINCE RUPERT, BC, CANADA | N | NO | -0- | 1436 |
| YQB | QUEBEC, QUE, CANADA | N | NO | -0- | 1356 |
| YQD | THE PAS, MAN, CANADA | N | NO | -0- | 630 |
| YQG | WINDSOR, ONT, CANADA | N | NO | -0- | 2351 |
| YQH | WATSON LAKE, YT, CANADA | N | NO | -0- | 335 |
| YQR | REGINA, SASK, CANADA | N | NO | -0- | 3925 |
| YQT | THUNDER BAY, ONT, CANADA | N | NO | -0- | 6659 |
| YQU | GRANDE PRAIRIE, ALBA, CANADA | N | NO | -0- | 1568 |
| YQX | GANDER, NFLD, CANADA | N | NO | -0- | 748 |
| YQY | SYDNEY, NS, CANADA | N | NO | -0- | 1846 |
| YQZ | QUESNEL, BC, CANADA | N | NO | -0- | 442 |
| YRB | RESOLUTE, NT, CANADA | N | NO | -0- | 417 |
| YSB | SUBDURY, ONT, CANADA | N | NO | -0- | 1092 |
| YSJ | SAINT JOHN, NB, CANADA | N | NO | -0- | 1358 |
| YSM | FT SMITH, NWT, CANADA | N | NO | -0- | 1252 |
| YSR | NANISIVIK NWT, CANADA | N | NO | -0- | 208 |
| YTH | THOMPSON, MAN, CANADA | N | NO | -0- | 1006 |
| YUL | MONTREAL, QUEBEC, CANADA | N | NO | -0- | 19081 |
| YUM | YUMA, AZ, USA | N | YES | AZ | 31 |
| YUX | HALL BEACH, NWT, CANADA | N | NO | -0- | 210 |
| YVO | VAL D'OR, QUE, CANADA | N | NO | -0- | 1887 |
| YVP | FT CHIMO, QUE, CANADA | N | NO | -0- | 1178 |
| YVQ | NORMAN WELLS, NWT, CANADA | N | NO | -0- | 1133 |
| YVR | VANCOUVER, BC, CANADA | N | NO | -0- | 38426 |
| YWG | WINNIPEG, MAN, CANADA | N | NO | -0- | 13898 |
| YWK | WABUSH, NFLD, CANADA | N | NO | -0- | 964 |
| YWL | WILLIAMS LAKE, BC, CANADA | N | NO | -0- | 442 |
| YXC | CRANBROOK, BC, CANADA | N | NO | -0- | 2712 |
| YXD | EDMONTON-MUNICIPAL, ALBERTA, CANADA | N | NO | -0- | 10271 |
| YXE | SASKATOON, SASK, CANADA | N | NO | -0- | 3934 |
| YXJ | FT ST JOHN, BC, CANADA | N | NO | -0- | 3958 |
| YXS | PRINCE GEORGE, BC, CANADA | N | NO | -0- | 5052 |
| YXT | TERRACE, BC, CANADA | N | NO | -0- | 1790 |
| YXU | LONDON, ONT, CANADA | N | NO | -0- | 422 |
| YXY | WHITEHORSE, YT, CANADA | N | NO | -0- | 1479 |
| YYC | CALGARY, ALBERTA, CANADA | N | NO | -0- | 33327 |
| YYD | SMITHERS, BC, CANADA | N | NO | -0- | 904 |
| YYE | FT NELSON, BC, CANADA | N | NO | -0- | 962 |
| YYF | PENTICTON, BC, CANADA | N | NO | -0- | 2964 |
| YYG | CHARLOTTETOWN, PEI, CANADA | N | NO | -0- | 1699 |
| YYJ | VICTORIA, BC, CANADA | N | NO | -0- | 871 |

| AIRPORT | APTDEF | HEMISPHR | CONUS | ABBR | STGFY87 |
|---|---|---|---|---|---|
| YYL | LYNN LAKE, MAN, CANADA | N | NO | -0- | 32 |
| YYQ | CHURCHILL, MAN, CANADA | N | NO | -0- | 412 |
| YYR | GOOSE BAY, NFLD, CANADA | N | NO | -0- | 1733 |
| YYT | ST JOHNS, NFLD, CANADA | N | NO | -0- | 4331 |
| YYY | MONT JOLI, QUE, CANADA | N | NO | -0- | 276 |
| YYZ | TORONTO, ONTARIO, CANADA | N | NO | -0- | 44100 |
| YZF | YELLOWKNIFE, NWT, CANADA | N | NO | -0- | 3253 |
| YZP | SANDSPIT, BC, CANADA | N | NO | -0- | 774 |
| YZT | PORT HARDY, BC, CANADA | N | NO | -0- | 708 |
| YZV | SETP-ILES, QUE, CANADA | N | NO | -0- | 603 |
| ZAD | ZADAR, YUGOSLAVIA | N | NO | -0- | 52 |
| ZAG | ZAGREB, YUGOSLAVIA | N | NO | -0- | 6743 |
| ZAH | ZAHEDAN, IRAN | N | NO | -0- | 88 |
| ZHA | ZHANGJIANG, P. R. CHINA | N | NO | -0- | 416 |
| ZIH | IXTAPA/ZIHUATANEJO, MEXICO | N | NO | -0- | 44 |
| ZNZ | ZANZIBAR, TANZANIA | S | NO | -0- | 1098 |
| ZRH | ZURICH, SWITZERLAND | N | NO | -0- | 12226 |
| ZTH | ZAKINTHOS, GREECE | N | NO | -0- | 676 |
| ZUM | CHURCHILL FALLS, NFLD, CANADA | N | NO | -0- | 216 |

## APPENDIX B
## CONTENTS OF FAA BIRD INGESTION DATA BASE - BOEING 737 AIRPLANE
## OCTOBER 1986 - SEPTEMBER 1987

This appendix presents the contents of small engine bird ingestion data base maintained by the FAA. The appendix presents actual data extracted from the FAA database and used in this report. When the null symbol -0- appears in any data position it indicates that the data are unknown. The data base contents are described below:

| COLUMN | DESCRIPTION OF COLUMN CONTENTS |
|---|---|
| EDATE | Date (mm/dd/yyyy) of ingestion event. |
| EVT# | FAA ingestion event sequence number reflecting order in which events were entered into the FAA bird ingestion data base. |
| ENG_POS | Engine position of engine ingesting bird. Since each engine ingestion event has a unique record in the data base, duplicate event numbers indicate multiple engine ingestion events. This column provides record uniqueness in such cases.<br>1 - left engine of 737 airplane<br>2 - right engine of 737 airplane |
| ETIME | Local time of bird ingestion. |
| SIGN_EVT | Significant event factors.<br>AIRWRTHY - engine related airworthiness effects<br>INV POS LOSS - involuntary power loss<br>MULT BIRDS - multiple birds in 1 engine<br>MULT ENG - multiple engine ingestion (1 bird in each engine)<br>MULT ENG-BIRDS - multiple engine ingestion and 1 or both engines sustained multiple bird ingestion<br>TRVS FRAC - transverse fan blade fracture<br>OTHER - other significant factor, may be reported in narrative remarks<br>NONE - no significant factor noted |
| AIRCRAFT | 737 aircraft type. |
| POF | Phase of flight during which bird ingestion occurred.<br>(TAXI;TAKEOFF;CLIMB;CRUISE;DESCENT;LANDING;UNKNOWN) |
| ALTITUDE | Altitude (ft. AGL) at time of bird ingestion. |
| SPEED | Air speed (kn) at time of bird ingestion. |
| FL_RULES | Flight rules in effect at time of bird ingestion.<br>IFR - instrument flight rules<br>VFR - visual flight rules<br>UNK - unknown |

| | |
|---|---|
| LT_COND | Light conditions at time of bird ingestion.<br>(DARK;LIGHT;DAWN;DUSK;etc.) |
| WEATHER | Weather conditions at time of bird ingestion. |
| CREW_AC | Crew action taken in response to bird ingestion.<br>ATO - aborted takeoff<br>ATB - air turnback<br>DIV - diversion<br>UNK - unknown<br>NONE - no crew action taken<br>N/A - not applicable<br>OTHER - some action taken, may be specified in narrative remarks |
| CREW_AL | Indicates whether crew alerted to presence of birds at time of bird ingestion.<br>(YES;NO;UNKNOWN) |
| BIRD_SEE | Indicates whether ingested bird(s) seen prior to ingestion<br>NO - not seen<br>YES - seen<br>SEVERAL - 2 to 10 birds observed<br>FLOCK - more than 10 birds observed |
| BIRD_NAM | Common bird name. Trailing asterisk (*) implies bird not positively identified as such. |
| BIRD_SPE | Species of positively identified bird. Alphanumeric identification code which conforms to Edward's convention. |
| #_BIRDS | Number of birds ingested. A (-2) implies more than one bird but the exact count is unknown. |
| WT_OZ_1 | Weight (oz.) of first ingested bird. |
| CTY_PRS | Scheduled city pairs of aircraft operation.<br>(from code:to code) 3 letter city airport code.<br>Reference AIRPORT column in Appendix A. |
| AIRPORT | Airport at which bird ingestion event occurred.<br>3 letter city airport code. Reference AIRPORT column in Appendix A. |
| LOCALE | Nearest town, state, country, etc. |
| US_INCID | Indicates whether bird ingestion occurred within United States boundaries.<br>(YES;NO) |

---

Edwards, E.P., "A Coded List of Birds of the World,"
IBSN:911882-04-9, 1974.

ENGINE Engine model.
(CFM56;JT8D)

DASH Engine dash number.

DMG_CODE Letter codes summarizing engine damage resulting from the bird ingestion. This column does not exist in the actual FAA database, but was developed by the contractor to compress 17 YES/NO damage fields into a single column. A letter code appears for damage columns whose values are YES. Each page of damage information contains a legend identifying the damage type. In the explanation of damage codes below, a number in parentheses indicates the damage severity code which is further explained in the SEVERITY column. The database column name is given in the explanation of the damage code.

- A(4) - ENG_DAM; engine damaged due to bird ingestion
- B(3) - LEAD_EDG; leading edge distortion/curl, minor fan blades
- C(3) - BEN/DEN; 1 to 3 fan blades bent or dented
- D(2) - BE/DE>3; more than 3 fan blades bent or dented
- E(3) - TORN<3; 1 to 3 fan blades torn
- F(2) - TORN>3; more than 3 fan blades torn
- G(2) - BROKEN; broken fan blade(s), leading edge and/or tip pieces missing; other blades also dented
- H(3) - SHINGLED; shingled (twisted) fan blades
- I(1) - TRVSFRAC; transverse fracture - a fan blade broken chordwise (across) and the piece liberated (includes secondary hard object damage)
- J(2) - SPINNER; dented, broken, or cracked spinner (includes spinner cap)
- K(1) - CORE; bent/broken compressor blades/vanes, blade/vane clash, blocked/disrupted airflow in low, intermediate, and high pressure compressors
- L(3) - NACELLE; dents and/or punctures to the engine enclosure (includes cowl)
- M(1) - FLANGE; flange separations
- N(2) - RELEASED; released (walked) fan blades
- O(1) - TURBINE; turbine damage
- P - OTHER; any damage not previously listed
- Q - UNKNOWN

SEVERITY Numeric code indicating the severity of engine damage resulting from the bird ingestion. This column does not exist in the actual FAA database, but was developed by the contractor as a result of an analysis of reported damage in the database. The lower the severity code, the more severe the damage. The severity rating assigned to a flight is determined as the lowest severity rating attained by any of the damage categories. The corresponding severity ratings for each damage category were given in parentheses in the DMG_CODE discussion above.

- 1 - most severe damage (damage is known)
- 2 - moderately severe damage (damage is known)
- 3 - least severe damage (damage is known)
- 4 - damage indicated, but not specified
- 9 - no damage reported

POW_LOSS Degree of power loss as a result of bird ingestion
NONE - no power loss
EPR DEC - engine pressure ratio decrease
SPOOL DOWN - engine spooled down
N1 CHANGE - N1 rotor change
N2 CHANGE - N2 rotor change
COMPRESSOR - compressor surge/stall
UNKNOWN - unknown whether power loss occurred

MAX_VIBE Maximum vibration reported as a dimensionless unit.

THROTTLE Voluntary throttle change by crew in response to bird ingestion.
ADVANCE - voluntary throttle advance
RETARD - voluntary throttle retard
IDLE - voluntary throttle retard to idle
CUTOFF voluntary throttle retard to cutoff
NONE - no voluntary throttle change

IFSD Indicate whether in-flight shutdown occurred in response to bird ingestion.
NO - no shutdown
VIBES - shutdown due to vibrations
STAL/SURG - shutdown due to compressor stall/surge
HI EGT - shutdown due to high exhaust gas temperature
EPR - shutdown due to incorrect engine pressure ratio
INVLNTRY - involuntary engine shutdown
PARAMTRS - shutdown due to incorrect engine parameters
OTHER - other reasons, may be listed in remarks
UNKNOWN - unknown cause for shutdown

REMARKS Narrative description providing additional information concerning some aspect of the ingestion.

FAA BIRD INGESTION DATABASE, BOEING 737 AIRCRAFT, OCTOBER 1986 - SEPTEMBER 1987

| EDATE | EVT# | ENG POS | ETIME | SIGN EVT | AIRCRAFT | POF | ALTITUDE | SPEED | FL RULES | LT CONDS | WEATHER | CREW AC | CREW AL | BIRD SEE | BIRD NAM | BIRD SPE | # BIRDS | WT OZ 1 | CTY P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/01/1986 | 1 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 10/02/1986 | 2 | 2 | 16:20:00 | NONE | 300 | CLIMB | 700 | -0- | IFR | -0- | OVERCAST | DIV | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 10/02/1986 | 3 | 2 | -0- | NONE | 300 | TAXI | 0 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 10/04/1986 | 235 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -C- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 10/05/1986 | 4 | 1 | -0- | NONE | 300 | TAKEOFF | 100 | 160 | VFR | -0- | CLEAR | ATB | NO- | YES | GULL* | -0- | 1 | -0- | -0- |
| 10/08/1986 | 5 | 2 | -0- | NONE | 300 | TAXI | 0 | -0- | VFR | LIGHT | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 10/10/1986 | 233 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | 0 | BOM- |
| 10/10/1986 | 234 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | MAN-C |
| 10/13/1986 | 6 | 2 | 8:00:00 | MULT ENG | 300 | TAKEOFF | -0- | 146 | VFR | DAWN | SCATTERED | ATB | -0- | FLOCK | GRAY-HEADED LAPWING | 5N20 | 1 | 9. | -0- |
| 10/13/1986 | 6 | 1 | 8:00:00 | MULT ENG | 300 | TAKEOFF | -0- | 146 | VFR | DAWN | SCATTERED | ATB | -0- | FLOCK | GRAY-HEADED LAPWING | 5N20 | 1 | 9. | -0- |
| 10/14/1986 | 232 | 2 | -0- | NONE | 200 | LANDING | 0 | 125 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | B |
| 10/16/1986 | 7 | 2 | -0- | MULT ENG-BIRDS | 300 | APPROACH | -0- | -0- | -0- | -0- | CLEAR | NONE | -0- | FLOCK | STARLING | 21Z75 | 3 | 3. | -0- |
| 10/16/1986 | 7 | 1 | -0- | MULT ENG-BIRDS | 300 | APPROACH | -0- | -0- | -0- | -0- | CLEAR | NONE | -0- | FLOCK | STARLING | 21Z75 | 1 | 3. | -0- |
| 10/19/1986 | 230 | 1 | -0- | NONE | 200 | LANDING | 0 | 90 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -T |
| 10/19/1986 | 231 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | ELS- |
| 10/20/1986 | 228 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0 | -0- | -0- | -0- | 1 | -0- | -0- |
| 10/20/1986 | 229 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | -0- | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | 1 | -0- | CCU- |
| 10/21/1986 | 226 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 10/21/1986 | 227 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | 145 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | 1 | -0- | GAU- |
| 10/23/1986 | 62 | 1 | -0- | MULT BIRDS | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -2 | -0- | -0- |
| 10/25/1986 | 236 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 10/26/1986 | 8 | 1 | -0- | MULT ENG | 300 | TAKEOFF | -0- | -0- | VFR | -0- | -0- | DIV | -0 | -0- | -0- | -0- | 1 | -0- | -0- |
| 10/26/1986 | 8 | 2 | -0- | MULT ENG | 300 | TAKEOFF | -0- | -0- | VFR | -0- | -0- | DIV | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 10/28/1986 | 9 | 2 | -0- | MULT ENG-BIRDS | 200 | APPROACH | -0- | -0- | -0- | -0- | -0- | -0- | -0- | SEVERAL | ROCK DOVE | 2P1 | 1 | 14. | PIT-R |
| 10/28/1986 | 9 | 1 | -0- | MULT ENG-BIRDS | 200 | APPROACH | -0- | -0- | -0- | -0- | -0- | -0- | -0- | SEVERAL | ROCK DOVE | 2P1 | -2 | 14. | PIT-F |
| 10/28/1986 | 10 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 10/29/1986 | 11 | 1 | -0- | NONE | 300 | TAKEOFF | 0 | 130 | VFR | DAY | PARTLY CLOUD | ATB | YES | FLOCK | ROBIN OR PIGEON* | -0- | -0- | -0- | -0- |
| 10/29/1986 | 12 | 1 | -0- | NONE | 300 | CLIMB | -0- | 90 | -0- | -0- | -0- | NONE | -0- | SEVERAL | GULL* | -0- | 1 | -0- | -0 |
| 10/30/1986 | 225 | 1 | -0- | NONE | 200 | LANDING | 0 | 20 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | 4. | GAU |
| 11/01/1986 | 13 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | NO | NIGHTHAWK | 5T5 | 1 | 2. | -0- |
| 11/02/1986 | 423 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/03/1986 | 14 | 1 | -0- | NONE | 300 | UNKNOWN | 0 | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/04/1986 | 15 | 1 | -0- | NONE | 300 | TAKEOFF | 0 | (100 | VFR | -0- | OVERCAST | NONE | NO | NO | -0- | -0- | 1 | -0- | -0- |
| 11/04/1986 | 73 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 145 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 11/04/1986 | 161 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0 | -0- | -0- | 1 | -0- | -0- |
| 11/07/1986 | 16 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -( |
| 11/07/1986 | 74 | 1 | -0- | NONE | 200 | LANDING | 0 | 125 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 11/09/1986 | 17 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/09/1986 | 18 | 2 | -0- | NONE | 300 | APPROACH | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0 | -0- | -0- | -0- | -0- |
| 11/10/1986 | 19 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | CLT- |
| 11/10/1986 | 20 | 1 | 21:13:00 | NONE | 200 | TAKEOFF | 100 | -0- | VFR | DARK | CLEAR | NONE | YES | -0- | -0- | -0- | 1 | -0- | PEN- |
| 11/14/1986 | 75 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 145 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 11/14/1986 | 76 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | -0- | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 11/15/1986 | 21 | 2 | 18:30:00 | MULT ENG-BIRDS | 200 | TAKEOFF | -0- | -0- | -0- | DARK | -0- | NONE | NO | NO | ROCK DOVE | 2P1 | 1 | 14. | ORD- |
| 11/15/1986 | 21 | 1 | 18:30:00 | MULT ENG-BIRDS | 200 | TAKEOFF | -0- | -0- | -0- | DARK | -0- | NONE | NO | NO | ROCK DOVE | 2P1 | 2 | 14. | ORD- |
| 11/15/1986 | 22 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/15/1986 | 23 | 2 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | 0- | GRAY-HEADED LAPWING | 5N20 | 1 | 7. | -0- |
| 11/18/1986 | 24 | 2 | -0- | NONE | 300 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/20/1986 | 25 | 1 | 15:51:00 | NONE | 200 | TAKEOFF | 0 | 120 | VFR | LIGHT | CLEAR | NONE | NO | NO | -0- | -0- | 1 | -0- | LIH- |
| 11/22/1986 | 26 | 1 | 23:08:00 | NONE | 200 | APPROACH | 500 | -0- | -0- | DARK | CLEAR | NONE | -0- | SEVERAL | -0- | -0- | 1 | -0- | KUL- |
| 11/23/1986 | 27 | 1 | -0- | MULT ENG | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 11/23/1986 | 27 | 2 | -0- | MULT ENG | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 11/23/1986 | 28 | 1 | 13:00:00 | NONE | 300 | TAKEOFF | -0- | -0- | -0- | LIGHT | CLEAR | NONE | -0- | -0- | -0- | -0- | -0 | -0 | -0- |
| 11/24/1986 | 300 | 2 | -0- | MULT ENG | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | - |
| 11/24/1986 | 300 | 1 | -0- | MULT ENG | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | - |
| 11/26/1986 | 29 | 1 | 15:50:00 | NONE | 200 | TAKEOFF | 0 | -0- | VFR | LIGHT | CLEAR | OTHER | NO | NO | BLACK WINGED PLOVER | 5N10 | 1 | 6. | LLW- |
| 11/26/1986 | 30 | 2 | 19:30:00 | NONE | 200 | TAKEOFF | 0 | -0- | -0- | DARK | -0- | -0- | -0- | YES | RING BILLED GULL | 14N12 | 1 | 16. | LGA- |

| | BIRD SPE | # BIRDS | WT OZ 1 | CTY PRS | AIRPORT | LOCALE | US INCID | ENGINE | DASH | DMG CODE | SEVERITY | POW LOSS | MAX VIBE | THROTTLE | IFSD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -0- | -0- | -0- | -0- | BEG | BELGRADE, YUGOSLAVIA | NO | CFM56 | 3 | A,B | 3 | NONE | 2.0 | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | TVL | LAKE TAHOE, CA | YES | CFM56 | 3 | A,B | 3 | -0- | 4.0 | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | CTU | CHENGDU, CHINA | NO | CFM56 | 3 | A,B | 3 | -0- | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | CHINA | NO | JT8D | -0- | A,G | 2 | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | MDT | HARRISBURG, PA | YES | CFM56 | 3 | A,H | 3 | NONE | -0- | NONE | NO | AM EVENT, MEDIUM BIRD |
| | -0- | -0- | -0- | -0- | PEK | BEIJING, CHINA | NO | CFM56 | 3 | | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | 0 | BOM- | XFO | INDIA | NO | JT8D | -0- | A,H | 3 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | MAN-CDG | MAN | MANCHESTER, ENGLAND | NO | JT8D | 15 | A,C | 3 | -0- | -0- | -0- | -0- | CCOC PS4 CRACK |
| D LAPWING | 5N20 | 1 | 9. | -0- | KMG | KUNMING, CHINA | NO | CFM56 | 3 | | 2 | NONE | -0- | NONE | NO | -0- |
| LAPWING | 5N20 | 1 | 9. | -0- | KMG | KUNMING, CHINA | NO | CFM56 | 3 | A,B,E | 3 | -0- | 5.0 | IDLE | NO | -0- |
| | -0- | 1 | -0- | -BOM | BOM | BOMBAY, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | THUD REPORTED |
| | 21775 | 3 | 3. | -0- | DAL | DALLAS/FT WORTH, TEX-LOVE | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | 21Z75 | 1 | 3. | -0- | DAL | DALLAS/FT WORTH, TEX-LOVE | YES | CFM56 | 3 | | -0- | NONE | -0 | NONE | NO | -0- |
| | -0- | 1 | -0- | -TRV | TRV | TRIVANDRUM, INDIA | NO | JT8D | 9A | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | ELS- | ELS | EAST LONDON, SOUTH AFRICA | NO | JT8D | 17 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | XFO | CHINA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | CCU- | CCU | CALCUTTA, INDIA | NO | JT8D | -0- | A,C | 3 | 0 | -0 | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | 17 | A,C,G | 2 | -0- | 0 | -0- | -0- | -0- |
| | -0- | 1 | -0- | GAU- | GAU | GAUHATI, INDIA | NO | JT8D | 17A | A,C | 3 | -0- | YES | 0- | -0- | VIBRATION, THUD, SMELL |
| | -0- | -2 | -0- | -0- | GHU | GUALEGUAYCHU, CHINA | NO | JT8D | 17A | A,B | 3 | -0- | -0- | NONE | NO | 7 FAN BLADES REQUIRED LE TIP REPAIR |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | 3 FAN BLADES BENT |
| | -0- | 1 | -0- | -0- | SNA | ORANGE COUNTY, CA | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | SNA | ORANGE COUNTY, CA | YES | CFM56 | 3 | A,H | 3 | NONE | 3.0 | NONE | NO | -0- |
| | 2P! | 1 | 14. | PIT-ROA | ROA | ROANOAK, VA | YES | JT8D | 15 | | -0- | NONE | -0- | NONE | NO | TURBINE FAILED ON 11/10/86 |
| | 2PI | -? | 14. | PIT-ROA | ROA | ROANOAK, VA | YES | JT8D | 15 | | 3 | NONE | -0 | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | DAL | DALLAS/FT WORTH, TEX-LOVE | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| GEON* | -0- | -0- | -0- | -0- | CLT | CHARLOTTE, NC | YES | CFM56 | 3 | A,C,H | 3 | NONE | 5.0 | IDLE | NO | -0- |
| | -0- | 1 | -0- | -0 | BHM | BIRMINGHAM, ALA | YES | CFM56 | 3 | | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | 4. | GAU | XFO | INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | 5T5 | 1 | 2. | -0- | XUS | -0- | YES | JT8D | 15 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | XUS | MIDWAY AIRPORT | YES | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | KHI | KARACHI, PAKISTAN | NO | CFM56 | 3 | A,H | 1 | NONE | 3.8 | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | ALB | ALBANY, NY | YES | CFM56 | 3 | A,B,H | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | HYD | HYDERABAD, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | 15 | | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | SXR | SRINAGAR, INDIA | NO | JT8D | 17A | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | SAT | SAN ANTONIO, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | DEN | DENVER, COL | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | CLT-DCA | CLT | CHARLOTTE, NC | YES | CFM56 | 3 | | -0- | NONE | 4.0 | NONE | NO | -0- |
| | -0- | 1 | -0- | PEN-KUL | PEN | PENANG, MAY | NO | JT8D | 15A | A,C | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | BLR | BANGALORE, INDIA | NO | JT8D | -0- | | -0 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | BBI | BHUBANESWAR, INDIA | NO | JT8D | -0- | | -0- | -0- | -0 | -0 | NO | -0- |
| | 2P1 | 1 | 14. | ORD-CLT | ORD | CHICAGO, IL | YES | JT8D | 15 | A,G | 2 | NONE | -0- | NONE | NO | -0- |
| | 2P1 | 2 | 14. | ORD-CLT | ORD | CHICAGO, IL | YES | JT8D | 15 | A,C,E,G | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | CNS | CAIRNS, QLD.,AUSTR..A | NO | CFM56 | 3 | A,C,H | 3 | NONE | -0- | NONE | NO | -0 |
| LAPWING | 5N20 | 1 | 7. | -0- | AMS | AMSTERDAM, NETHERLANDS | NO | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | DFW | DALLAS/FT WORTH, TEX | YES | CFM56 | 3 | A,H | 3 | NONE | 5.0 | IDLE | NO | -0- |
| | -0- | 1 | -0- | LIH-HNL | LIH | LIHUE, KAUAI, HAWAII | YES | JT8D | 9A | A,B,C | 3 | NONE | -0 | NONE | NO | SMALL BIRD |
| | -0- | 1 | -0- | KUL-AOR | AOR | KEDAH, MALAYSIA | NO | JT8D | 15 | A,D,H | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | LHE | LAHO[illegible] PAKISTAN | NO | CFM56 | 3 | A | 4 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | LHE | LAHORE, PAKISTAN | NO | CFM56 | 3 | A | 4 | NONE | -0- | NONE | NO | -0- |
| | -0- | -0 | -0 | -0- | HOU | HOUSTON, TEX | YES | CFM56 | 3 | A,B,H | 3 | NONE | HIGH | NONE | NO | -0- |
| | -0- | 1 | -0- | -WLG | XFO | WELLINGTON, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | ODOR |
| | -0- | 1 | -0- | -WLG | XFO | WELLINGTON, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | ODOR |
| PLOVER | 5N10 | 1 | 6. | LLW-BLZ | LLW | LILONGWE, MALAWI | NO | JT8D | 17A | A,D,G | 2 | NONE | -0- | NONE | NO | ODOR IN CABIN |
| ULL | 14N12 | 1 | 16. | LGA-CLE | LGA | NEW YORK, NY | YES | JT8D | 7 | A,C,G | 2 | NONE | -0- | NONE | NO | -0- |

| EDATE | EVT# | ENG_POS | ETIME | SIGN EVT | AIRCRAFT | POF | ALTITUDE | SPEED | FL RULES | LT CONDS | WEATHER | CREW AC | CREW AL | BIRD SEE | BIRD NAM | BIRD SPE | # BIRDS | WT_OZ I | CTY PI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11/27/1986 | 31 | 1 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/27/1986 | 424 | 1 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 11/29/1986 | 77 | 1 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 12/02/1986 | 72 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | 2. | -C |
| 12/03/1986 | 32 | 1 | 7:14:00 | MULT BIRDS | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 2 | -0- | -0- |
| 12/08/1986 | 34 | 1 | 16:00:00 | NONE | 300 | APPROACH | -0- | -0- | -0- | -0- | OVERCAST | NONE | -0- | FLOCK | -0- | -0- | -0- | -0- | -0- |
| 12/12/1986 | 35 | 2 | 19:00:00 | NONE | 300 | CLIMB | 500 | 180 | VFR | DARK | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 12/13/1986 | 36 | 1 | -0- | MULT BIRDS | 300 | CLIMB | 500 | -0- | IFR | -0- | RAIN | ATB | -0- | -0- | -0- | -0- | -2 | -0- | -0- |
| 12/13/1986 | 79 | 2 | -0- | MULT BIRDS | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -2 | -0- | -0- |
| 12/14/1986 | 37 | 2 | 15:30:00 | NONE | 300 | CLIMB | 1000 | 190 | IFR | DAY | OVERCAST | ATB | NO | FLOCK | HERRING GULL | 14N14 | 1 | 40. | -0- |
| 12/14/1986 | 57 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 100 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 12/14/1986 | 80 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 12/14/1986 | 457 | 2 | -0- | NONE | 300 | CLIMB | 1000 | 210 | IFR | DAY | OVERCAST | -0- | NO | NO | GULL* | -0- | 1 | -0- | -0- |
| 12/15/1986 | 81 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | 145 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 12/17/1986 | 38 | 2 | -0- | NONE | 200 | LANDING | 0 | -0- | -0- | -0- | -0- | ATB | NO | YES | MALLARD | 2J84 | 1 | 40. | MSO-M |
| 12/17/1986 | 162 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 12/19/1986 | 82 | 2 | -0- | NONE | 200 | LANDING | 0 | 90 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 12/20/1986 | 58 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 12/24/1986 | 237 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 12/26/1986 | 42 | 2 | -0- | TRVS FRAC | 200 | CLIMB | 150 | -0- | -0- | -0- | OVERCAST | ATB | -0- | YES | HERRING GULL | 14N14 | 1 | 40. | ORD-M |
| 12/31/1986 | 39 | 1 | 11:39:00 | MULT ENG | 300 | LANDING | -0- | -0- | -0- | LIGHT | CLEAR | NONE | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 12/31/1986 | 39 | 2 | 11:39:00 | MULT ENG | 300 | LANDING | -0- | -0- | -0- | LIGHT | CLEAR | NONE | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 01/02/1987 | 43 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 50 | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | 1 | -0- | FAT-B |
| 01/02/1987 | 301 | 1 | -0- | NONE | 200 | LANDING | 0 | 115 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | OKA-M |
| 01/04/1987 | 302 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | MMY-0 |
| 01/07/1987 | 44 | 1 | -0- | MULT BIRDS | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | 2 | -0- | -0- |
| 01/08/1987 | 83 | 1 | -0- | NONE | 200 | LANDING | 0 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | 4. | -0- |
| 01/09/1987 | 84 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 01/09/1987 | 238 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | SCATTERED | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 01/09/1987 | 303 | -0- | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -A |
| 01/09/1987 | 304 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -C |
| 01/10/1987 | 45 | 1 | -0- | MULT BIRDS | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | SEVERAL | CROW* | -0- | -2 | -0- | -0- |
| 01/16/1987 | 40 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | VFR | -0- | -0- | ATB | -0- | NO | HORNED LARK | 17Z74 | 1 | 2. | OAK-N |
| 01/17/1987 | 46 | 1 | -0- | TRVS FRAC | 300 | TAKEOFF | 0 | -V1 | -0- | -0- | ICY | DIV | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 01/19/1987 | 41 | 2 | 17:30:00 | NONE | 200 | CLIMB | 200 | 150 | VFR | DUSK | SCATTERD | ATB | NO | FLOCK | CANADIAN GOOSE | 2J30 | 1 | 128. | RND-O |
| 01/28/1987 | 47 | 1 | -0- | MULT ENG | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | FLOCK | GULL* | -0- | 1 | -0- | -0- |
| 01/28/1987 | 47 | 2 | -0- | MULT ENG | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | FLOCK | GULL* | -0- | 1 | -0- | -0- |
| 01/31/1987 | 239 | 2 | 12:58:00 | NONE | 200 | LANDING | 0 | 110 | -0- | -0- | CLEAR | NONE | NO | FLOCK | GULL* | -0- | 1 | -0- | -0- |
| 02/02/1987 | 459 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 120 | VFR | DAY | RAIN | -0- | NO | ONE | DOVE* | -0- | 1 | -0- | [illegible] |
| 02/06/1987 | 356 | 2 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 02/08/1987 | 240 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 02/10/1987 | 305 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 02/10/1987 | 428 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 140 | VFR | DAY | PARTLY CLOUD | ATB | YES | NO | -0- | -0- | -0- | -0- | -0- |
| 02/10/1987 | 429 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 02/10/1987 | 458 | 2 | -0- | MULT ENG | 200 | TAKEOFF | 0 | 140 | VFR | DAY | PARTLY CLOUD | -0- | YES | FLOCK | GULL* | -0- | 1 | -0- | -0- |
| 02/10/1987 | 458 | 1 | -0- | MULT ENG | 200 | TAKEOFF | 0 | 140 | VFR | DAY | PARTLY CLOUD | -0- | YES | FLOCK | GULL* | -0- | 1 | -0- | -0- |
| 02/11/1987 | 85 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0 | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 02/13/1987 | 430 | -0- | 12:52:00 | NONE | 300 | TAKEOFF | 0 | 140 | -0- | -0- | -0- | -C- | -0- | SEVERAL | GULL* | -0- | -0- | -0- | -0- |
| 02/14/1987 | 357 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0 | -0- |
| 02/17/1987 | 59 | 1 | 10:30:00 | NONE | 200 | TAKEOFF | 35 | 150 | VFR | DAY | CLEAR | ATB | NO | ONE | GOLDEN PLOVER | 5N25 | 1 | 6. | OGG-H |
| 02/19/1987 | 60 | 1 | 16:00:00 | NONE | 200 | TAKEOFF | 0 | -0- | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | 1 | -0- | OUR-P |
| 02/23/1987 | 61 | 2 | 10:30:00 | NONE | 200 | CLIMB | 10000 | 200 | VFR | DAY | CLEAR | NONE | NO | NO | GLAUCOUS WINGED GULL | 14N22 | 1 | 56. | PDX-F |
| 02/25/1987 | 241 | 1 | 11:55:00 | NONE | 200 | TAKEOFF | 0 | 145 | -0- | -0- | SCATTERED | -0- | -0- | YES | -0- | -0- | 1 | -0- | -0- |
| 02/27/1987 | 49 | 1 | -0- | NONE | 300 | CLIMB | -0- | -0- | VFR | -0- | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 02/27/1987 | 242 | 2 | 6:10:00 | NONE | 200 | LANDING | 0 | 100 | -0- | -0- | RAIN | -0- | NO | SEVERAL | -0- | -0- | 1 | -0 | -0- |
| 02/28/1987 | 86 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 03/02/1987 | 306 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -C |
| 03/03/1987 | 460 | -0- | -0- | NONE | -0- | TAKEOFF | 0 | 120 | VFR | NIGHT | CLEAR | -0- | NO | NO | -0- | -0- | 1 | -0- | -0- |

| AM | BIRD SPE | # BIRDS | WT_OZ | CTY PRS | AIRPORT | LOCALE | US INCID | ENGINE | DASH | DMG CODE | SEVERITY | POW LOSS | MAX VIBE | THROTTLE | IFSD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -0- | -0- | -0- | -0- | PDX | PORTLAND, ORE | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | PDX | PORTLAND, ORE | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | BLR | BANGALORE, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | 2. | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | 15 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | 2 | -0- | -0- | VCM | ARGENTINA | NO | JT8D | -0- | A,G | 2 | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | DAL | DALLAS/FT WORTH, TEX-LOVE | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | TFS | TENERIFE | NO | CFM56 | 3 | A,H | 3 | NONE | 2.0 | NONE | NO | -0- |
| | -0- | -2 | -0- | -0- | AMS | AMSTERDAM, NETHERLANDS | NO | CFM56 | 3 | A,B | 3 | NONE | OFFSC | IDLE | VIBES | -0- |
| | -0- | -2 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| S GULL | 14N14 | 1 | 40. | -0- | SFO | SAN FRANCISCO/OAKLAND, CA | YES | CFM56 | 3 | A,B,H | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | 15 | | -0- | NONE | NONE | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | SFO | SAN FRANCISCO, CA | YES | CFM56 | 3 | A,D | 2 | -0- | -0- | -0- | -0- | PM EVENT |
| | -0- | 1 | -0- | -0- | MAD | MADRID, SPAIN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | 2J84 | 1 | 40. | MSO-MSO | MSO | MISSOULA, MONT | YES | JT8D | -0- | A,D,H | 2 | NONE | -0- | -0- | NO | ATB DUE TO WEATHER |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | TRV | TRIVANDRUM, INDIA | NO | JT8D | 9A | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0 | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | 15 | A,C | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0 | -0- | XFO | BRAZIL | NO | JT8D | 17A | A,C | 3 | -0- | -0- | -0- | YES | -0- |
| GULL | 14N14 | 1 | 40. | ORD-MSY | ORD | CHICAGO, IL | YES | JT8D | 7 | A,D,F,G,I, | 1 | -0- | VIBS | -0- | -0- | #1 CMPT FIRE |
| | -0- | 1 | -0- | -0- | HOU | HOUSTON, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | HOU | HOUSTON, TEX | YES | CFM56 | 3 | A,H | 3 | NONE | HIGH | NONE | NO | -0- |
| | -0- | 1 | -0- | FAT-BFL | FAT | FRESNO, CA | YES | JT8D | 17 | | -0- | COMPRESSOR | -0- | IDLE | NO | -0- |
| | -0- | -0- | -0- | OKA-MMY | MMY | MIYAKO JIMA, JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | C |
| | -0- | -0- | -0- | MMY-OKA | MMY | MIYAKO JIMA, JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 2 | -0- | -0- | MEL | MELBOURNE, AUSTRALIA | NO | CFM56 | 3 | | -0- | NONE | NONE | NONE | NO | -0- |
| | -0- | 1 | 4. | -0- | JAI | JAIPUR, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | VNS | VARANASI, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | MAN | MANCHESTER, ENGLAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -AKL | XFO | AUCKLAND, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | ODOR |
| | -0- | -0- | -0- | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0 | -0- |
| | -0- | -2 | -0- | -0- | LST | LAUNCESTON, TASMANIA | NO | CFM56 | 3 | A | 4 | NONE | -0- | NONE | NO | -0- |
| ARK | 17774 | 1 | 2. | OAK-NR | OAK | SAN FRANCISCO, CA-OAKLAND | YES | JT8D | 17 | A,D | 1 | EPR DEC | -0- | CUTOFF | VIBES | -0- |
| | -0- | -0- | -0- | -0- | MUC | MUNICH, GERMANY | NO | CFM56 | 3 | A,C,I | 1 | NONE | -0- | NONE | NO | -0- |
| GOOSE | 2J30 | 1 | 128. | RNO-OEN | RNO | RENO, NEV | YES | JT8D | 17 | A,G | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | TGD | TITOGRAD, YUGOSLAVIA | NO | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | TGD | TITOGRAD, YUGOSLAVIA | NO | CFM56 | 3 | A,H | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | LCA | LARNACA, CYPRUS | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | MEDIUM BIRD |
| | -0- | 1 | -0- | -0- | OGG | KAHULUI, MAUI, HAWAII | YES | JT8D | -0- | A,K | 1 | -0- | -0- | -0- | -0- | AM EVENT |
| | -0- | -0- | -0- | -0- | XFO | SOUTH AFRICA | NO | JT8D | 17 | A,C | 3 | -0- | -0- | -0- | [illegible] | -0- |
| | -0- | -0- | -0- | -0- | XFO | -0- | NO | JT8D | 15 | A,C | 3 | -0- | -0- | -0- | -0- | ENGINE REMOVED FOR FAN ASSEMBLY OVERHAUL |
| | -0- | -0- | -0- | -0- | AKL | AUCKLAND, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | ODOR |
| | -0- | -0- | -0- | -0- | SJC | SAN JOSE, CA | YES | JT8D | 9 | A,K | 1 | -0- | -0- | -0- | -0- | COMPRESSOR SECTION BLADE DAMAGE |
| | -0- | -0- | -0- | -0- | SJC | SAN JOSE, CA | YES | JT8D | 9 | | -0- | -0- | -0- | -0- | -0- | LOUD BANG HEARD |
| | -0- | 1 | -0- | -0- | MDW | MIDWAY, ILL | YES | JT8D | 15 | A | 4 | -0- | -0- | -0- | -0- | PM EVENT, EXTENSIVE INLET DAMAGE |
| | -0- | 1 | -0- | -0- | MDW | MIDWAY, ILL | YES | JT8D | 15 | A | 4 | -0- | -0- | -0- | -0- | PM EVENT |
| | -0- | 1 | -0- | -0- | TRV | TRIVANDRUM, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | HAM | HAMBURG, GERMANY | NO | CFM56 | 3 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | XFO | ARGENTINA | NO | JT8D | 9A | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| LOVER | 5025 | 1 | 6. | OGG-HNL | OGG | KAHULUI, MAUI, HAWAII | YES | JT8D | 9A | A,C,H | 3 | NONE | -0- | NONE | NO | SMALL BIRD |
| | -0- | 1 | -0- | DUR-PLZ | DUR | DURBAN, SOUTH AFRICA | NO | JT8D | 17A | | -0- | NONE | -0- | NONE | NO | -0- |
| WINGED GULL | 14N22 | 1 | 56. | PDX-RNO | PDX | PORTLAND, ORE | YES | JT8D | 7 | A,D,G | 2 | NONE | NONE | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | MUC | MUNICH, GERMANY | NO | JT8D | -0- | | -0- | -0- | -0 | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | ALB | ALBANY, NY | YES | CFM56 | 3 | A,H | 3 | NONE | 4.9 | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | STR | STUTTGART, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | LARGE BIRD |
| | -0- | 1 | -0- | -0- | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | 15 | A,G | 2 | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0 | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | PIE | ST PETERSBURG, FL | YES | -0- | -0- | | -0- | -0- | -0- | -0- | -0- | PM EVENT |

| EDATE | EVT# | ENG_POS | ETIME | SIGN_EVT | AIRCRAFT | POF | ALTITUDE | SPEED | FL_RULES | LT_CONDS | WEATHER | CREW_AC | CREW_AL | BIRD SEE | BIRD NAM | BIRD SPE | # BIRDS | WT_OZ_1 | CTY P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 03/10/1987 | 50 | 1 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | OVERCAST | NONE | -0- | -0- | SHORE (HORNED) LARK | 17274 | 1 | 1.5 | -0- |
| 03/11/1987 | 358 | 1 | -0- | NONE | 200 | LANDING | 100 | 124 | -0- | -0- | -0- | -0- | -0- | NO | -0- | -0- | -0- | -0- | DEN-( |
| 03/12/1987 | 359 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 03/13/1987 | 63 | 2 | 13:20:00 | NONE | 200 | TAKEOFF | 50 | 125 | VFR | DAY | CLEAR | NONE | NO | SEVERAL | -0- | -0- | 1 | -0- | LIH-I |
| 03/16/1987 | 87 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 03/17/1987 | 64 | 1 | 7:45:00 | NONE | 200 | UNKNOWN | 400 | -0- | VFR | -0- | -0- | NONE | -0- | NO | BLACK-HEADED GULL | 14K36 | 1 | 10. | BAH-( |
| 03/18/1987 | 88 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 03/19/1987 | 51 | 1 | -0- | NONE | 300 | APPROACH | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 03/21/1987 | 52 | 1 | 13:50:00 | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 03/21/1987 | 53 | 1 | 19:00:00 | NONE | 300 | TAKEOFF | 1200 | 150 | IFR | -0- | CLEAR | ATB | -0- | -0- | DUCK OR GOOSE* | -0- | -0- | -0- | -0- |
| 03/21/1987 | 65 | 1 | 15:00:00 | NONE | 200 | TAKEOFF | 0 | 150 | -0- | -0- | CLEAR | ATB | -0- | NO | GULL* | -0- | -0- | -0- | PIE-1 |
| 03/21/1987 | 89 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 03/21/1987 | 90 | 2 | -0- | MULT BIRDS | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -2 | -0- | -0- |
| 03/23/1987 | 54 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 03/25/1987 | 307 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 120 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | MMY-( |
| 03/26/1987 | 66 | 1 | 18:35:00 | INV POW LOSS | 200 | TAKEOFF | 0 | 139 | -0- | -0- | RAIN | ATB | -0- | YES | SPOTTED THICK-KNEE | 9M | 1 | 15. | JNB-I |
| 03/26/1987 | 67 | 1 | -0- | NONE | 200 | LANDING | 0 | 80 | -0- | -0- | CLEAR | -0- | -0- | NO | -0- | -0- | 1 | -0- | JNB-I |
| 03/27/1987 | 91 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 03/28/1987 | 55 | 2 | -0- | NONE | 300 | TAKEOFF | 1000 | -0- | VFR | -0- | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | FLL-I |
| 03/29/1987 | 92 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 145 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 03/29/1987 | 243 | 2 | 12:47:00 | NONE | 200 | LANDING | 0 | 114 | -0- | -0- | SCATTERED | -0- | NO | ONE | -0- | -0- | 1 | -0- | -0- |
| 03/29/1987 | 360 | -0- | -0- | NONE | 200 | LANDING | 0 | 114 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 03/30/1987 | 56 | 1 | -0- | NONE | 300 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 03/30/1987 | 308 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | - |
| 03/31/1987 | 425 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0 | -0- | -0- | -0- |
| 04/01/1987 | 68 | 2 | 14:10:00 | MULT BIRDS | 200 | TAKEOFF | 0 | 90 | -0- | -0- | CLEAR | ATO | -0- | FLOCK | SWALLOW* | -0- | -2 | -0- | PLZ- |
| 04/03/1987 | 244 | 2 | 9:00:00 | NONE | 200 | TAXI | 0 | 40 | -0- | -0- | SCATTERED | -0- | -0- | SEVERAL | -0- | -0- | 1 | -0- | -0- |
| 04/03/1987 | 309 | -0- | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 04/05/1987 | 245 | 2 | 23:59:00 | NONE | 200 | CLIMB | 10 | 140 | -0- | -0- | SCATTERED | -0- | NO | YES | -0- | -0- | -0- | -0- | -0- |
| 04/07/1987 | 93 | 2 | -0- | NONE | 200 | LANDING | 0 | 90 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 04/07/1987 | 361 | -0- | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 04/09/1987 | 106 | 1 | 19:40:00 | NONE | 300 | TAKEOFF | 0 | -V1 | -0- | -0- | CLEAR | DIV | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 04/11/1987 | 107 | 1 | 22:30:00 | NONE | 300 | CLIMB | 600 | 160 | IFR | DARK | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | SYD- |
| 04/12/1987 | 246 | 2 | -0- | MULT BIRDS | 200 | APPROACH | 100 | 140 | -0- | -0- | SCATTERED | -0- | YES | SEVERAL | -0- | -0- | 2 | -0- | -0- |
| 04/14/1987 | 108 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 04/17/1987 | 109 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | AMERICAN KESTREL | 5K26 | 1 | 4. | -0- |
| 04/21/1987 | 70 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | -0- | ATB | -0- | -0- | ROCK DOVE | 2P1 | 1 | 14. | -0- |
| 04/22/1987 | 247 | -0- | 8:03:00 | NONE | 200 | CLIMB | -0- | 210 | -0- | -0- | CLEAR | -0- | NO | NO | -0- | -0- | 1 | -0- | -0- |
| 04/23/1987 | 248 | 2 | 10:38:00 | NONE | 200 | TAKEOFF | 0 | 110 | -0- | -0- | CLEAR | -0- | NO | YES | -0- | -0- | 1 | -0- | -0- |
| 04/26/1987 | 310 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | - |
| 04/26/1987 | 311 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | WLG- |
| 05/01/1987 | 312 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | - |
| 05/01/1987 | 362 | -0- | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 05/03/1987 | 69 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 150 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | PIE- |
| 05/04/1987 | 110 | 1 | 18:38:00 | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | SAT- |
| 05/10/1987 | 94 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/10/1987 | 111 | 2 | 22:00:00 | NONE | 300 | TAKEOFF | -0- | -0- | -0- | -0- | RAIN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | LIT- |
| 05/12/1987 | 95 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/12/1987 | 363 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/16/1987 | 364 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 05/17/1987 | 313 | 2 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 05/18/1987 | 249 | 1 | 13:40:00 | MULT BIRDS | 200 | APPROACH | 300 | 140 | -0- | -0- | SCATTERED | -0- | NO | YES | -0- | -0- | 2 | -0- | -0- |
| 05/20/1987 | 250 | 2 | 8:17:00 | MULT BIRDS | 200 | TAKEOFF | 0 | 100 | -0- | -0- | CLEAR | -0- | -0- | SEVERAL | -0- | -0- | 2 | -0- | -0- |
| 05/22/1987 | 96 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/22/1987 | 97 | 1 | -0- | NONE | 200 | TAKEOFF | 0 | 85 | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/22/1987 | 98 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/24/1987 | 99 | 1 | 7:35:00 | TRVS FRAC | 200 | TAKEOFF | 0 | 140 | VFR | -0- | -0- | ATB | -0- | YES | CATTLE EGRET | 1I35 | 1 | 16. | -0- |
| 05/24/1987 | 251 | 2 | 6:30:00 | NONE | 200 | LANDING | 0 | 90 | -0- | -0- | SCATTERED | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |

| | BIRD_SPE | # BIRDS | WT_OZ_1 | CTY_PRS | AIRPORT | LOCALE | US_INCID | ENGINE | DASH | DMG_CODE | SEVERITY | POW_LOSS | MAX_VIBE | THROTTLE | IFSD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ) LARK | 17774 | 1 | 1.5 | -0- | PEK | BEIJING, CHINA | NO | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | DEN-OAK | OAK | SAN FRANCISCO, CA-OAKLAND | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | XFO | -0- | NO | JT8D | 17A | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | LIH-HNL | LIH | LIHUE, KAUAI, HAWAII | YES | JT8D | 9A | | -0- | NONE | -0- | NONE | NO | MEDIUM BIRD |
| | -0- | 1 | -0- | -0- | IXB | BAGDOGRA, INDIA | NO | JT8D | -0- | A,H | 3 | -0- | -0- | -0- | NO | -0- |
| GULL | 14N36 | 1 | 10. | BAH-DHA | XFO | SAUDI-ARABIA | NO | JT8D | 15 | A,D,H | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | JAI | JAIPUR, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | SYD | SIDNEY, NSW, AUSTRALIA | NO | CFM56 | 3 | | -0- | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -0- | ZRH | ZURICH, SWITZERLAND | NO | CFM56 | 3 | A,H | 3 | NONE | -0- | NONE | NO | -0- |
| E* | -0- | -0- | -0- | -0- | MSP | MINN./ST. PAUL, MINN | YES | CFM56 | 3 | A,H | 3 | NONE | 4.0 | IDLE | NO | -0- |
| | -0- | -0- | -0- | PIE-YYZ | PIE | ST. PETERSBURG, FL | YES | JT8D | 9A | A,G | 2 | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | PAT | PATNA, INDIA | NO | JT8D | 17 | A,H | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | -2 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | UET | QUETTA, PAKISTAN | NO | CFM56 | 3 | A,D,E | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | MMY-OKA | MMY | MIYAKO JIMA, JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| X-KNEE | 9M4 | 1 | 15. | JNB-DUR | JNB | JOHANNESBURG, SOUTH AFRICA | NO | JT8D | 17A | A,C | 3 | COMPRESSOR | HIGH | CUTOFF | INVLNTRY | -0- |
| | -0- | 1 | -0- | JNB-WDH | WDH | NAMIBIA, S.W. AFRICA | NO | JT8D | 17A | A,C | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | FLL-PHL | FLL | FT.LAUDERDALE/HOLLYWOOD,FL | YES | CFM56 | 3 | A,D | 2 | NONE | -0- | NONE | NO | -0- |
| | -0- | 1 | -0- | -0- | AKL | AUCKLAND, NEW ZEALAND | NO | JT8D | 15 | A,D,H | 2 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | GERMANY | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | NCE | NICE, FRANCE | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | DEN | DENVER, COL | YES | CFM56 | 3 | A,H | 3 | NONE | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | -AKL | XFO | AUCKLAND, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0 | -0- | -0- | -0- | XUS | -0- | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -2 | -0- | PLZ-LON | PLZ | PORT ELIZABETH, S. AFRICA | NO | JT8D | 17A | | -0- | COMPRESSOR | -0- | IDLE | NO | -0- |
| | -0- | 1 | -0- | -0- | FRA | FRANKFURT, GERMANY | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | SMALL BIRD |
| | -0- | -0- | -0- | -0- | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | 0 | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | KCH | KUCHING, MALAYSIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | CCU | CALCUTTA, INDIA | NO | JT8D | 17 | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | XFO | ZAIRE | NO | JT8D | 15 | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | CPH | COPENHAGEN, DENMARK | NO | CFM56 | 3 | A,H | 3 | NONE | 3.9 | -0- | NO | -0- |
| | -0- | -0- | -0- | SYD-MEL | SYD | SYDNEY, NSW, AUSTRALIA | NO | CFM56 | 3 | A,C | 3 | NONE | -0- | -0- | NO | -0- |
| | -0- | 2 | -0- | -0- | ZTH | ZAKINTHOS, GREECE | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | FRA | FRANKFURT, GERMANY | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| TREL | 5K26 | 1 | 4. | -0- | DAL | DALLAS/FT.WORTH,TEX-LOVE | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | 2P1 | 1 | 14. | -0- | XFO | -0- | NO | JT8D | 17A | A,G | 2 | COMPRESSOR | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | PEN | PENANG, MALAYSIA | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | MAN | MANCHESTER, ENGLAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | SMALL BIRD |
| | -0- | -0- | -0- | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | WLG-OUD | WLG | WELLINGTON, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | ODOR |
| | -0- | -(- | -0- | -AKL | XFO | AUCKLAND, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | XFO | NIGERIA | NO | JT8D | 15A | A,G | 2 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | PIE-YYZ | PIE | ST. PETERSBURG, FL | YES | JT8D | 9A | | -0- | COMPRESSOR | -0- | NONE | NO | -0- |
| | -0- | -0- | -0- | SAT-HOU | SAT | SAN ANTONIO, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | JRH | JORHAT, INDIA | NO | JT8D | -0- | A,H | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | LIT-HOU | LIT | LITTLE ROCK, ARK | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | BOM | BOMBAY, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | ENGLAND | NO | JT8D | 15A | A,C | 3 | -0- | -0- | -0- | -0- | 3 FAN BLADES DAMAGED |
| | -0- | -0- | -0- | -0- | XFO | -0- | NO | JT8D | 15 | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | LARGE BIRD |
| | -0- | 2 | -0- | -0- | LHR | LONDON, ENGLAND-HEATHROW | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 2 | -0- | -0- | AOR | ALOR SETAR, MALAYSIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | BLR | BANGALORE, INDIA | NO | JT8D | -0- | A,H | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | VNS | VARANASI, INDIA | NO | JT8D | -0- | | -0- | COMPRESSOR | -0- | -0- | NO | POWER LOSS |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| T | 1135 | 1 | 16. | -0- | LOS | LAGOS, NIGERIA | NO | JT8D | 15 | A,I | 1 | COMPRESSOR | -0- | -0- | INVLNTRY | -0- |
| | -0- | 1 | -0- | -0- | ELS | EAST LONDON, SOUTH AFRICA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | LARGE BIRD |

| EDATE | EVT# | ENG_POS | ETIME | SIGN EVT | AIRCRAFT | POF | ALTITUDE | SPEED | FL_RULES | LT_CONDS | WEATHER | CREW AC | CREW AL | BIRD SEE | BIRD_NAM | BIRD SPE | # BIRDS | WT OZ 1 | CTY F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05/25/1987 | 164 | 2 | 8:53:00 | NONE | 200 | TAKEOFF | 15 | -0- | VFR | -0- | CLEAR | -0- | -0- | ONE | SPARROW* | -0 | 1 | 3. | -0- |
| 05/26/1987 | 252 | 1 | 16:00:00 | NONE | 200 | APPROACH | 300 | -0- | -0- | -0- | CLEAR | -0- | NO | YES | -0- | -0- | -0- | -0- | -0- |
| 05/27/1987 | 314 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -( |
| 05/28/1987 | 100 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 05/28/1987 | 165 | 1 | 20:30:00 | NONE | 200 | APPROACH | 300 | 150 | VFR | -0- | SCATTERED | -0- | -0- | YES | SWALLOW* | -0- | 1 | 3. | -f |
| 05/29/1987 | 112 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 05/30/1987 | 253 | 2 | 10:50:00 | NONE | 200 | APPROACH | 82 | 140 | -0- | -0- | CLEAR | -0- | NO | YES | -0- | -0- | 1 | -0- | -0- |
| 05/31/1987 | 113 | 2 | 14:55:00 | NONE | 300 | TAKEOFF | 0 | 110 | -0- | BRIGHT | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 05/31/1987 | 254 | 1 | 17:06:00 | NONE | 200 | APPROACH | 150 | 135 | -0- | -0- | -0- | -0- | YES | SEVERAL | -0- | -0- | 1 | -0- | -0- |
| 06/02/1987 | 71 | 1 | 16:05:00 | NONE | 200 | TAKEOFF | 0 | -0- | VFR | -0- | CLEAR | ATO | NO | NO | GULL* | -0- | 1 | -0- | ORF-( |
| 06/03/1987 | 315 | 1 | -0- | NONE | 200 | LANDING | 50 | 120 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | ISG-( |
| 06/04/1987 | 114 | 1 | 14:45:00 | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | KGS-( |
| 06/05/1987 | 115 | 2 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | CLEAR | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 06/08/1987 | 116 | 1 | -0- | NONE | 300 | CRUISE | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 06/09/1987 | 255 | 1 | 20:20:00 | NONE | 200 | TAKEOFF | 0 | 120 | -0- | -0- | SCATTERED | ATO | -0- | YES | -0- | -0- | 1 | -0- | -0- |
| 06/10/1987 | 101 | 1 | 16:10:00 | NONE | 200 | LANDING | 0 | 120 | VFR | -0- | -0- | -0- | -0- | YES | -0- | -0- | 1 | -0- | YYC-' |
| 06/13/1987 | 117 | 1 | -0- | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | CLEAR | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 06/13/1987 | 256 | 2 | 4:03:00 | MULT ENG | 200 | TAKEOFF | 0 | -0- | -0- | -0- | SCATTERED | -0- | -0- | YES | -0- | -0- | 1 | -0- | -0- |
| 06/13/1987 | 256 | 1 | 4:03:00 | MULT ENG | 200 | TAKEOFF | 0 | -0- | -0- | -0- | SCATTERED | -0- | -0- | YES | -0- | -0- | 1 | -0- | -0- |
| 06/13/1987 | 365 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 06/14/1987 | 316 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | ISG-( |
| 06/15/1987 | 257 | 2 | 16:45:00 | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | CLEAR | -0- | NO | YES | -0- | -0- | 1 | -0- | -0- |
| 06/17/1987 | 118 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 06/17/1987 | 317 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | OKA-( |
| 06/19/1987 | 119 | 1 | 9:09:00 | NONE | 300 | LANDING | 50 | 140 | VFR | DAY | PARTLY CLOUD | NONE | NO | FLOCK | GULL* | -0- | -0- | -0- | -0- |
| 06/22/1987 | 166 | 1 | 15:45:00 | NONE | 200 | CLIMB | 500 | -0- | VFR | -0- | SCATTERED | -0- | -0- | YES | SWALLOW* | -0- | 1 | 3. | -0- |
| 06/22/1987 | 258 | 1 | -0- | NONE | 200 | APPROACH | -0- | 114 | -0- | -0- | SCATTERED | -0- | NO | YES | -0- | -0- | 1 | -0- | -0- |
| 06/25/1987 | 102 | 2 | 12:56:00 | NONE | 200 | LANDING | 0 | 90 | VFR | -0- | CLEAR | -0- | NO | ONE | NORTHERN MARSH | 3K78 | 1 | 18. | LAS- |
| 06/27/1987 | 103 | -0- | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | FERAL PIGEON* | -0- | 1 | 14. | -0- |
| 06/27/1987 | 259 | 1 | 10:07:00 | NONE | 200 | LANDING | 0 | 110 | -0- | -0- | SCATTERED | -0- | -0- | YES | -0- | -0- | 1 | -0- | -0- |
| 06/27/1987 | 318 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0 | -0- | -0- |
| 06/29/1987 | 427 | 1 | -0- | NONE | 200 | CLIMB | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | RED TAI* | -0- | -0- | -0- | -0- |
| 07/02/1987 | 260 | 1 | 14:15:00 | NONE | 200 | APPROACH | 80 | 120 | -0- | -0- | SCATTERED | -0- | NO | YES | -0- | -0- | -0- | -0- | -0- |
| 07/02/1987 | 366 | -0- | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | - |
| 07/02/1987 | 431 | -0- | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 07/03/1987 | 319 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 07/04/1987 | 261 | 2 | 15:15:00 | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | BELOW CLOUDS | -0- | NO | -0- | -0- | -0- | -0- | -0- | -0- |
| 07/05/1987 | 133 | 2 | 8:25:00 | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | CLEAR | NONE | -0- | -0- | -0- | -0- | 1 | -0- | SDF- |
| 07/06/1987 | 134 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | . |
| 07/07/1987 | 104 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- |
| 07/09/1987 | 135 | 2 | 0:42:00 | NONE | 300 | LANDING | -0- | -0- | -0- | NIGHT | -0- | NONE | -0- | -0- | -0- | -(- | -0- | -0- | ORY- |
| 07/11/1987 | 262 | 1 | 12:20:00 | NONE | 200 | CLIMB | 3000 | 170 | -0- | -0- | SCATTERED | -0- | NO | YES | -0- | -0- | 1 | -0- | -0- |
| 07/13/1987 | 105 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | AGR |
| 07/13/1987 | 171 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | NO | -0- | -0- | -0- | -0- | |
| 07/14/1987 | 136 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | |
| 07/14/1987 | 137 | 2 | -0- | NONE | 300 | APPROACH | 7000 | 137 | VFR | DAY | CLEAR | -0- | NO | NO | -0- | -0- | 1 | -0- | |
| 07/14/1987 | 138 | 1 | -0- | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | 1 | -0- | TLV |
| 07/15/1987 | 263 | 1 | 9:35:00 | NONE | 200 | TAKEOFF | 0 | -0- | -0- | -0- | CLEAR | -0- | NO | NO | -0- | -0- | 1 | -0- | -0- |
| 07/16/1987 | 320 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | |
| 07/17/1987 | 367 | -0- | -0- | NONE | 200 | CLIMB | 1000 | 155 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 07/17/1987 | 432 | -0- | 18:39:00 | NONE | 300 | APPROACH | 300 | 130 | -0- | -0- | -0- | -0- | -0- | ONE | -0- | -0- | -0- | -0- | -0- |
| 07/19/1987 | 139 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | |
| 07/19/1987 | 264 | 2 | 20:26:00 | MULT BIRDS | 100 | TAKEOFF | 0 | -0- | -0- | -0- | SCATTERED | -0- | NO | SEVERAL | -0- | -0- | 2 | -0- | -0- |
| 07/21/1987 | 140 | 2 | 7:00:00 | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | DAWN | CLEAR | -0- | -0- | -0- | -0- | -0- | 1 | -0- | DM |
| 07/21/1987 | 265 | 2 | 15:20:00 | NONE | 200 | APPROACH | 100 | 125 | -0- | -0- | CLEAR | -0- | NO | YES | -0- | -0- | 1 | -0- | -0 |
| 07/21/1987 | 426 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | -0- | -0- | -0 |
| 07/23/1987 | 122 | 2 | 19:00:00 | NONE | 200 | TAKEOFF | 0 | 110 | VFR | -0- | -0- | -0- | -0- | NO | -0- | -0- | 1 | -0- | MM |
| 07/26/1987 | 123 | 1 | 18:37:00 | NONE | 200 | TAKEOFF | 0 | 150 | -0- | -0- | -0- | -0- | -0- | FLOCK | -0- | -0- | -0- | -0- | GE |

| | BIRD SPE | # BIRDS | WT OZ 1 | CTY PRS | AIRPORT | LOCALE | US INCID | ENGINE | DASH | DMG CODE | SEVERITY | POW LOSS | MAX VIBE | THROTTLE | IFSD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -0- | 1 | 3. | -0- | CGN | COLOGNE/BONN, GERMANY | NO | JT8D | 15 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | KUL | KUALA LUMPUR, MALAYSIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | MEDIUM BIRD |
| | -0- | -0- | -0- | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | A,H | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | 3. | -FRA | FRA | FRANKFURT, GERMANY | NO | JT8D | 15 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | AMS | AMSTERDAM, NETHERLANDS | NO | CFM56 | 3 | | -0- | NONE | 0 | -0- | NO | EVENT OCCURED DURING GO-ROUND |
| | -0- | 1 | -0- | -0- | ALG | ALGIERS, ALGERIA | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | SMALL BIRD |
| | -0- | -0- | -0- | -0- | TNG | TANGER, MOROCCO | NO | CFM56 | 3 | A,D | 2 | NONE | 3.8 | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | DUB | DUBLIN, IRELAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | ORF-CVG | ORF | NORFOLK, VA | YES | JT8D | 15A | A,D | 2 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | ISG-MMY | MMY | MIYAKO JIMA, JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | KGS-GEN | KGS | KOS, GREECE | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | GRZ | GRAZ, AUSTRIA | NO | CFM56 | 3 | A,H | 3 | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | SLC | SALT LAKE CITY, UT | YES | CFM56 | 3 | A | 4 | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | FRANCE | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | LARGE BIRD |
| | -0- | 1 | -0- | YYC-YXD | YXD | EDMONTON, ALTA-MUN.,CANADA | NO | JT8D | 9A | | -0- | COMPRESSOR | -0- | -0- | NO | SURGED ON GROUND |
| | -0- | -0- | -0- | -0- | LNZ | LINZ, AUSTRIA | NO | CFM56 | 3 | A,H | 3 | NONE | 5.0 | RETARD | NO | -0- |
| | -0- | 1 | -0- | -0- | LIN | MILAN, ITALY | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | LIN | MILAN, ITALY | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | MIL | MILAN, ITALY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | ISG-OKA | XFO | JAPAN | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -0- | ELS | EAST LONDON, SOUTH AFRICA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | MEDIUM BIRD |
| | -0- | -0- | -0- | -0- | IAD | WASHINGTON, DC-DULLES | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | OKA-MMY | XFO | JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | HRL | HARLINGEN, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | 3. | -0- | FRA | FRANKFURT, GERMANY | NO | JT8D | 15 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | CDG | PARIS, FRANCE-DEGAULLE | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| RN MARSH | 3K78 | 1 | 18. | LAS-OAK | OAK | SAN FRANSICO,CA-OAKLAND | YES | JT8D | 9A | A,C,H | 3 | NONE | -0- | RETARD | NO | -0- |
| PIGEON* | -0- | 1 | 14. | -0- | KHH | KAOHSIUNG, TAIWAN | NO | JT8D | 17A | A,G | 2 | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | TUN | TUNIS, TUNISIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0 | -0- | -0- | CHC | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | DAY | DAYTON, O | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | LARGE BIRD |
| | -0- | -0- | -0- | -0- | LHR | LONDON, ENGLAND-HEATHROW | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | MEDIUM BIRD |
| | -0- | -0- | -0- | -HAJ | XFO | HANOVER, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | TNG | TANGER, MOROCCO | NO | CFM56 | 3 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | EZE | BUENOS AIRES, ARGENTINA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | FRA | FRANKFURT, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | SDF-CLT | SDF | LOUISVILLE, KY | YES | CFM56 | 3 | A,C | 3 | NONE | 4.9 | -0- | NO | -0- |
| | -0- | 1 | -0- | -IAD | XUS | WASHINGTON, DC-DULLES | YES | CFM56 | 3 | A | 4 | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | XFO | -0- | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -(- | -0- | -0- | ORY-AJA | AJA | AJACCIO, CORSICA, FRANCE | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | BRU | BRUSSELS, BELGIUM | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | AGR-VNS | VNS | VARANASI, INDIA | NO | JT8D | 17 | A,G | 2 | -0- | -0- | -0- | NO | AIRCRAFT GROUNDFD DUE TO FOD |
| | -0- | -0- | -0- | -LAX | XUS | LOS ANGELES, CA | YES | JT8D | -0- | A,C,N | 2 | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| | -0- | 1 | -0- | -KHI | XFO | KARACHI, PAKISTAN | NO | CFM56 | 3 | A | 4 | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| | -0- | 1 | -0- | -TVL | XUS | LAKE TAHOE, CA | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | FOUND ON GRD INSPECTION, SMALL BIRD |
| | -0- | 1 | -0- | TLV-MUC | TLV | TELAVIA-YAFO, ISRAEL | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | DUR | DURBAN, SOUTH AFRICA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -CHC | XFO | CHRISTCHURCH, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | NUE | NUREMBURG, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | MUC | MUNICH, GERMANY | NO | CFM56 | 3 | A | 4 | -0- | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | -MUC | XFO | MUNICH, GERMANY | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| | -0- | 2 | -0- | -0- | XFO | FRANCE | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | DAB- LT | DAB | DAYTONA BEACH, FL | YES | CFM56 | 3 | A,C | 3 | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -0- | KST | KOSTI, SUDAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | EWR | NEW YORK, NY-NEWARK | YES | JT8D | 9A | A | 4 | YES | -0- | -0- | -0- | FAN BLADE DAMAGE |
| | -0- | 1 | -0- | MMY-OKA | MMY | MIYAKO JIMA, JAPAN | NO | JT8D | 17 | A,C,H,N | 2 | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | GOA-LGW | GOA | GENOVA, ITALY | NO | JT8D | 15A | | -0- | EPR DEC | -0- | -0- | NO | STRONG ODOR IN CABIN |

| EDATE | EVT# | ENG POS | ETIME | SIGN EVT | AIRCRAFT | POF | ALTITUDE | SPEED | FL RULES | LT CONDS | WEATHER | CREW AC | CREW AL | BIRD SEE | BIRD NAM | BIRD SPE | # BIRDS | WT OZ 1 | CTY PRS | AIRPORT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07/26/1987 | 124 | 2 | 9:00:00 | AIRWRTHY | 200 | TAKEOFF | 100 | 150 | VFR | -0- | -0- | ATB | -0- | -0- | GLAUCOUS-WINGED GULL | 14N22 | 1 | 40. | YYZ-YQG | YYZ |
| 07/26/1987 | 141 | 2 | -0- | NONE | 300 | LANDING | 0 | 80 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -DUS | DUS |
| 07/26/1987 | 266 | 1 | 20:37:00 | NONE | 200 | TAKEOFF | -0- | 140 | -0- | -0- | CLEAR | -0- | NO | YES | -0- | -0- | 1 | -0- | -0- | XFO |
| 07/27/1987 | 321 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | 130 | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | -0- | -0- | -0- | XFO |
| 07/29/1987 | 126 | 1 | 17:45:00 | NONE | 200 | TAKEOFF | 0 | 70 | -0- | -0- | -0- | -0- | -0- | YES | SPOTTED DOVE | 2P65 | 1 | 6. | ITO-HNL | ITO |
| 07/29/1987 | 142 | 1 | -0- | NONE | 300 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | AMS- | AMS |
| 07/29/1987 | 368 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | XUS |
| 07/30/1987 | 127 | 1 | 4:55:00 | AIRWRTHY | 200 | TAKEOFF | 0 | 130 | VFR | -0- | CLEAR | ATO | -0- | -0- | -0- | -0- | -0- | -0- | TXL-BRE | TXL |
| 07/30/1987 | 322 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | 100 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | ISG-OKA | ISG |
| 07/31/1987 | 143 | 1 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | 1 | -0- | HRL-HOU | HOU |
| 07/31/1987 | 144 | 1 | 9:55:00 | MULT BIRDS | 300 | TAKEOFF | 500 | +V1 | VFR | BRIGHT | OVERCAST | ATB | -0- | NO | -0- | -0- | 2 | -0- | -0- | ADL |
| 08/03/1987 | 128 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | -0- | XFO |
| 08/03/1987 | 129 | 2 | -0- | NONE | 200 | TAKEOFF | 0 | 90 | VFR | DAY | PARTLY CLOUD | ATO | NO | YES | -0- | -0- | 1 | -0- | RAP-FSD | RAP |
| 08/03/1987 | 205 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YYZ | XFO |
| 08/03/1987 | 267 | 2 | 9:22:00 | MULT BIRDS | 200 | LANDING | 0 | -0- | -0- | -0- | BELOW CLOUDS | -0- | -0- | SEVERAL | GULL* | -0- | -2 | 10. | MUC-ZRH | ZRH |
| 08/03/1987 | 369 | -0- | -0- | NONE | 200 | APPROACH | 1000 | 140 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | XRY |
| 08/04/1987 | 206 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATO | -0- | -0- | 0 | -0- | -0- | -0- | YAM-YYZ | YAM |
| 08/04/1987 | 323 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | WLG-DUD | WLG |
| 08/05/1987 | 145 | 1 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | DUSK | OVERCAST | NONE | -0- | -0- | GULL* | -0- | -0- | -0- | -BRS | BRS |
| 08/05/1987 | 146 | 1 | -0- | MULT ENG | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | 1 | -0- | -IBZ | IBZ |
| 08/05/1987 | 146 | 2 | -0- | MULT ENG | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | 1 | -0- | -IBZ | IBZ |
| 08/05/1987 | 207 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YVR | XFO |
| 08/05/1987 | 370 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | 130 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | FRA |
| 08/06/1987 | 147 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -AMS | XFO |
| 08/13/1987 | 208 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YYZ | XFO |
| 08/15/1987 | 433 | -0- | 9:00:00 | NONE | 300 | LANDING | 20 | 135 | -0- | -0- | -0- | -0- | -0- | ONE | FALCON* | -0- | -0- | -0- | -0- | TNG |
| 08/17/1987 | 130 | 2 | 15:30:00 | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | NO- | -0- | -0- | -0- | -0- | YVR-YYC | YYC |
| 08/17/1987 | 148 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -SNA | XUS |
| 08/19/1987 | 131 | 1 | -0- | MULT BIRDS | 200 | LANDING | 0 | -0- | VFR | -0- | -0- | -0- | -0- | YES | KILLDEER | 5N33 | -2 | 3. | YXJ-YXS | YXS |
| 08/20/1987 | 209 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YLW | XFO |
| 08/22/1987 | 324 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | ISG-OKA | XFO |
| 08/22/1987 | 371 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -BRU | XFO |
| 08/22/1987 | 372 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | GULL* | -0- | -0- | -0- | -FOR | XFO |
| 08/23/1987 | 373 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | STV |
| 08/25/1987 | 210 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YEG | XFO |
| 08/26/1987 | 188 | 1 | 8:23:00 | TRVS FRAC | 200 | LANDING | 0 | -0- | VFR | -0- | SCATTERED | -0- | -0- | YES | -0- | -0- | -0- | -0- | TYO-HAC | HAC |
| 08/26/1987 | 374 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | 140 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | HAM |
| 08/26/1987 | 451 | -0- | -0- | NONE | 200 | TAKEOFF | 0 | +V1 | -0- | NIGHT | CLEAR | ATO | NO | NO | -0- | -0- | -0- | -0- | -0- | LEX |
| 08/28/1987 | 325 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | -0- | -0- | -0- | OPO |
| 08/29/1987 | 211 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YXJ | XFO |
| 08/29/1987 | 268 | 1 | -0- | MULT BIRDS | 200 | TAKEOFF | 0 | -0- | -0- | -0- | BELOW CLOUDS | -0- | -0- | YES | SWALLOW* | -0- | 2 | 3. | FRA-LNZ | FRA |
| 08/29/1987 | 326 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | PMR-AKL | PMR |
| 08/31/1987 | 149 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -IAH | XUS |
| 08/31/1987 | 150 | 1 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -KHI | KHI |
| 08/31/1987 | 151 | 2 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -PHX | XUS |
| 08/31/1987 | 269 | 1 | 8:06:00 | NONE | 200 | TAKEOFF | 0 | -0- | VFR | -0- | -0- | -0- | -0- | ONE | GULL* | -0- | 1 | -0- | DUS-ZRH | DUS |
| 09/01/1987 | 327 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | 100 | -0- | -0- | -0- | -0- | -0- | FLOCK | PIGEON* | -0- | -0- | -0- | -0- | FNC |
| 09/02/1987 | 328 | 1 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | MZG-KHH | KHH |
| 09/03/1987 | 375 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | XFO |
| 09/06/1987 | 132 | 2 | 10:15:00 | NONE | 200 | LANDING | 0 | -0- | VFR | -0- | CLEAR | -0- | -0- | ONE | OSPREY | 2K1 | 1 | 56. | IAD-MCO | MCO |
| 09/06/1987 | 152 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -DUS | XFO |
| 09/07/1987 | 329 | 1 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | PMR |
| 09/08/1987 | 449 | 2 | -0- | NONE | 200 | LANDING | 35 | 130 | VFR | DAY | CLEAR | -0- | NO | FLOCK | GULL* | -0- | -0- | -0- | -0- | ORF |
| 09/09/1987 | 330 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | 140 | -0- | -0- | -0- | ATB | -0- | -0- | -0- | -0- | -0- | -0- | -0- | ORY |
| 09/10/1987 | 153 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -MUC | XFO |
| 09/10/1987 | 434 | -0- | 6:25:00 | NONE | 300 | TAKEOFF | 0 | 100 | -0- | -0- | -0- | -0- | -0- | -0- | BUZZARD OR FALCON* | -0- | -0- | -0- | -0- | FRA |
| 09/12/1987 | 212 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -YYC | XFO |
| 09/12/1987 | 270 | 1 | 17:40:00 | NONE | 200 | LANDING | 0 | 110 | -0- | -0- | BELOW CLOUDS | -0- | NO | YES | HAWK* | -0- | 1 | -0- | BEG-MUC | MUC |

| BIRD SPE | # BIRDS | WT OZ I | CTY PRS | AIRPORT | LOCALE | US INCID | ENGINE | DASH | DMG CODE | SEVERITY | POW LOSS | MAX VIBE | THROTTLE | IFSD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ), CAN22 | 1 | 40. | YYZ-YOG | YYZ | TORONTO, ONT., CANADA | NO | JT8D | 9A | A,B,G,H | 2 | COMPRESSOR | YES | -0- | YES | METAL IN TAILPIPE,9th STAGE BLADE DAMAGE |
| KGRF-0- | 1 | -0- | -DUS | DUS | DUSSELDORF, GERMANY | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| -0- | 1 | -0- | -0- | XFO | ITALY | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| -0- | -0- | -0- | -0- | XFO | -0- | NO | JT8D | -0- | A,G,H | 2 | -0- | -0- | -0- | -0- | EPR SYMPTOM |
| HAW965 | 1 | 6. | ITO-HNL | ITO | HILO, HAWAII | YES | JT8D | 9A | | -0- | -0- | -0- | -0- | NO | STRONG ODOR IN CABIN |
| DAM,-0- | 1 | -0- | AMS- | AMS | AMSTERDAM, NETHERLANDS | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| -0- | -0- | -0- | -0- | XUS | -0- | YES | JT8D | 7 | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| , WE-0- | -0- | -0- | TXL-BRE | TXL | BERLIN, WEST GERMANY | NO | JT8D | 15A | A,C,G,K | 1 | EPR DEC | -0- | CUTOFF | EPR | FAN CHANGE,ENG SHUTDOWN ON TAXI,COMP DAM |
| KI, -0- | -0- | -0- | ISG-OKA | ISG | ISHIGAKI, JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| N, T-0- | 1 | -0- | HRL-HOU | HOU | HOUSTON, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | STRONG ODOR IN CABIN |
| DE, -0- | 2 | -0- | -0- | ADL | ADELAIDE, S. AUSTRALIA | NO | CFM56 | 3 | A,B,D,H | 2 | -0- | -0- | RETARD | NO | -0- |
| ESBU-0- | 1 | -0- | -0- | XFO | JOHANNESBURG, SOUTH AFRICA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| CITY-0- | 1 | -0- | RAP-FSD | RAP | RAPID CITY, S. DAK | YES | JT8D | 9 | | -0- | COMPRESSOR | -0- | -0- | -0- | #2 ENGINE STALLED AT 80 KTS, PM EVENT |
| ), O-0- | -0- | -0- | -YYZ | XFO | TORONTO, ONT., CANADA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| , SWI-0- | -2 | 10. | MUC-ZRH | ZRH | ZURICH, SWITZERLAND | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | -0- |
| DELA-0- | -0- | -0- | -0- | XRY | JEREZ DELA FRONTERA, SPAIN | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| STE.-0 | -0- | -0- | YAM-YYZ | YAM | SAULT STE. MARIE, CANADA | NO | JT8D | 9A | | -0- | -0- | -0- | -0- | -0- | TIRE FAILURE |
| GTON-0- | -0- | -0- | WLG-DUD | WLG | WELLINGTON, NEW ZEALAND | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| L, E-0- | -0- | -0- | -BRS | BRS | BRISTOL, ENGLAND | NO | CFM56 | 3 | A,H | 3 | NONE | 3.5 | -0- | NO | EVENT OCCURRED IN PM |
| SPAI-0 | 1 | -0- | -IBZ | IBZ | IBIZA, SPAIN | NO | CFM56 | 3 | A,H | 3 | NONE | 2.2 | -0- | NO | -0- |
| SPAI-0- | 1 | -0- | -IBZ | IBZ | IBIZA, SPAIN | NO | CFM56 | 3 | A,H | 3 | NONE | -0- | -0- | NO | -0- |
| VER,-0- | -0- | -0- | -YVR | XFO | VANCOUVER, B.C., CANADA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| URT,-0- | -0- | -0- | -0- | FRA | FRANKFURT, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| DAM,-0- | -0- | -0- | -AMS | XFO | AMSTERDAM, NETHERLANDS | NO | CFM56 | 3 | A | 4 | NONE | -0- | -0- | NO | FOUND ON GRD INSPEC,4FAN BLADES REPLACED |
| O, O-0- | -0- | -0- | -YYZ | XFO | TORONTO, ONT., CANADA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| R, M-0- | -0- | -0- | -0- | TNG | TANGIER, MOROCCO | NO | CFM56 | 3 | | -0- | -0- | -0- | -0- | -0- | -0- |
| Y, AL-0- | -0- | -0- | YVR-YYC | YYC | CALGARY, ALTA , CANADA | NO | JT8D | 17A | A,H | 3 | -0- | -0- | -0- | NO | -0- |
| COUN-0- | 0- | -0- | -SNA | XUS | ORANGE COUNTY, CA | YES | CFM56 | 3 | A,C,H | 3 | NONE | HIGH | -0- | NO | -0- |
| GEOR033 | -2 | 3. | YXJ-YXS | YXS | PRINCE GEORGE,B.C., CANADA | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | MOMENTARY EGT INC OF 70 DEG.C,2-4 BIRDS |
| A, B-0- | -0- | -0- | -YLW | XFO | KELOWNA, B.C., CANADA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| -0- | -0- | -0- | ISG-OKA | XFO | JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| LS, E-0- | -0- | -0- | -BRU | XFO | BRUSSELS, BELGIUM | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| EZA, -0- | -0- | -0- | -FOR | XFO | FORTALEZA, CEARA, BRAZIL | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| INDI-0- | -0- | -0- | -0- | STV | SURAT, INDIA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| ON, A-0- | -0- | -0- | -YEG | XFO | EDMONTON, ALTA., CANADA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| ), JA-0- | -0- | -0- | TYO-HAC | HAC | HACHIJO, JAPAN | NO | JT8D | 9A | A,C,G,I | 1 | NONE | -0- | -0- | NO | 2,1st STAGE F BLADES WERE FRAC, 2nd DAM |
| G, GE-0- | -0- | -0- | -0- | HAM | HAMBURG, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| TON, -0- | -0- | -0- | -0- | LEX | LEXINGTON, KY | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | PM EVENT, LOUD ENGINE NOISE |
| PORT-0- | -0 | -0- | -0- | OPO | PORTO, PORTUGAL | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| . JOH-0- | -0- | -0- | -YXJ | XFO | FT. ST. JOHN, B.C., CANADA | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| RT, -0- | 2 | 3. | FRA-LNZ | FRA | FRANKFURT, GERMANY | NO | JT8D | 15 | | -0- | -0- | YES | -0- | NO | SYMPTOM - VIBRATION |
| STON,-0- | -0- | -0- | PMR-AKL | PMR | PALMERSTON, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| I, TE-0- | -0- | -0- | -IAH | XUS | HOUSTON, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| , PA-0- | -0- | -0- | -KHI | KHI | KARACHI, PAKISTAN | NO | CFM56 | 3 | A | 4 | NONE | <2 | -0- | NO | 3 FAN BLADES DAMAGED |
| , AR-0- | -0- | -0- | -PHX | XUS | PHOENIX, ARIZ | YES | CFM56 | 3 | A | 4 | NONE | -0- | -0- | NO | 1 FAN BLADE DAMAGED |
| ORF, -0- | 1 | -0- | DUS-ZRH | DUS | DUSSELDORF, GERMANY | NO | JT8D | 15 | | -0- | COMPRESSOR | -0- | -0- | NO | -0- |
| , PO-0- | -0- | -0- | -0- | FNC | FUNCHAL, PORTUGAL | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| NG, -0- | 1 | -0- | NZG-KHH | KHH | KAOHSIUNG, TAIWAN | NO | JT8D | -0- | A,H | 3 | -0- | -0- | -0- | -0- | [illegible]AN BLADES SHINGLED |
| -0- | -0- | -0- | -0- | XFO | ENGLAND | NO | JT8D | 9A | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| , FL XI | 1 | 56. | IAD-MCO | MCO | ORLANDO, FL | YES | JT8D | 7 | A,K | 1 | -0- | -0- | -0- | NO | LPC DAMAGED HOWEVER NOT DUE TO BIRD |
| DRF,-0- | -0- | -0- | -DUS | XFO | DUSSELDORF, GERMANY | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| TON,-0- | -0- | -0- | -0- | PMR | PALMERSTON, NEW ZEALAND | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| , VA-0- | -0- | -0- | -0- | ORF | NORFOLK, VA | YES | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | AM EVENT |
| RLY,-0- | -0- | -0- | -0- | ORY | PARIS-ORLY, FRANCE | NO | JT8D | -0- | | -0- | COMPRESSOR | -0 | -0- | -0- | ODOR |
| GER-0- | -0- | -0- | -MUC | XFO | MUNICH, GERMANY | NO | CFM56 | 3 | | -0- | NONE | -0- | -0 | NO | FOUND DURTNG GROUND INSPRCTION |
| RT, -0- | -0- | -0- | -0- | FRA | FRANKFURT, GERMANY | NO | CFM56 | 3 | | -0- | -0- | -0- | -0- | -0- | -0- |
| , AL-0- | -0- | -0- | -YYC | XFO | CALGARY, ALTA., CANADA | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| GER-0- | 1 | -0- | BEG-MUC | MUC | MUNICH, GERMANY | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | NO | MEDIUM BIRD |

| EDATE | EVT# | ENG POS | ETIME | SIGN EVT | AIRCRAFT | POF | ALTITUDE | SPEED | FL RULES | LT CONDS | WEATHER | CREW AC | CREW AL | BIRD SEE | BIRD NAM | BIRD SPE | # BIRDS | WT OZ 1 | CTY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 09/13/1987 | 154 | 1 | -0- | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | YU |
| 09/14/1987 | 172 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | 1 | -0- | PL |
| 09/15/1987 | 155 | 2 | 9:06:00 | NONE | 300 | TAKEOFF | 0 | 140 | IFR | BRIGHT | CLEAR | ATB | NO | ONE | SHARP-SHINNED HAWK | 3K105 | 1 | 6. | -0- |
| 09/15/1987 | 376 | 1 | -0- | NONE | 200 | LANDING | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | OR |
| 09/16/1987 | 156 | 1 | 13:33:00 | NONE | 300 | CLIMB | -0- | -0- | VFR | BRIGHT | CLEAR | NONE | -0- | -0- | YELLOW-BILLED CUCKOO | 2R51 | 1 | 7. | AU |
| 09/16/1987 | 377 | -0- | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- |
| 09/17/1987 | 157 | 1 | -0- | NONE | 300 | TAKEOFF | -0- | +V1 | -0- | -0- | -0- | NONE | -0- | -0- | -0- | -0- | -0- | -0- | ZR |
| 09/17/1987 | 271 | 1 | 18:45:00 | NONE | 200 | TAKEOFF | 20 | 150 | -0- | -0- | -0- | -0- | NO | FLOCK | DOVE* | -0- | -0- | -0- | BH |
| 09/17/1987 | 331 | 2 | -0- | NONE | 200 | LANDING | -0- | 40 | -0- | -0- | -0- | -0- | -0- | -0- | GULL* | -0- | -0- | -0- | -0- |
| 09/17/1987 | 378 | -0- | -0- | NONE | 200 | TAKEOFF | 20 | 150 | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0 |
| 09/18/1987 | 158 | 1 | -0- | NONE | 300 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | |
| 09/18/1987 | 167 | 1 | 16:50:00 | NONE | 200 | TAKEOFF | 20 | 150 | VFR | -0- | -0- | ATB | -0- | NO | SPARROW* | -0- | 1 | 4. | JN |
| 09/18/1987 | 379 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0 |
| 09/20/1987 | 332 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | 140 | -0- | -0- | -0- | ATO | -0- | -0- | -0- | -0- | -0- | -0- | -0 |
| 09/22/1987 | 159 | 2 | 0:43:00 | NONE | 300 | UNKNOWN | -0- | -0- | VFR | DARK | CLEAR | NONE | -0- | -0- | -0- | -0- | 1 | -0- | TU |
| 09/22/1987 | 169 | 1 | 9:57:00 | NONE | 200 | TAKEOFF | 0 | -0- | VFR | -0- | OVERCAST | ATO | -0- | NO | DOVE* | -0- | 1 | 14. | CP |
| 09/22/1987 | 272 | 1 | -0- | NONE | 200 | TAKEOFF | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | VULTURE* | -0- | 1 | -0- | -0 |
| 09/23/1987 | 160 | 1 | 19:20:00 | NONE | 300 | UNKNOWN | -0- | -0- | VFR | DARK | CLEAR | NONE | -0- | -0- | -0- | -0- | -0- | -0- | AU |
| 09/23/1987 | 450 | 2 | -0- | NONE | 200 | TAKEOFF | -0- | 80 | VFR | DAY | PARTLY CLOUD | ATO | NO | NO | DOVE* | -0- | 1 | -0- | -0 |
| 09/24/1987 | 380 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0 |
| 09/25/1987 | 333 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | IS |
| 09/27/1987 | 334 | 1 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | -0- | |
| 09/28/1987 | 170 | 1 | 17:23:00 | NONE | 200 | TAKEOFF | -0- | -0- | VFR | -0- | -0- | -0- | -0- | NO | -0- | -0- | -0- | -0- | CL |
| 09/29/1987 | 173 | 2 | -0- | NONE | 200 | UNKNOWN | -0- | -0- | -0- | -0- | -0- | -0- | -0- | NO | -0- | -0- | 1 | -0- | |
| 09/30/1987 | 204 | 1 | -0- | NONE | 300 | LANDING | -0- | -0- | -0- | -0- | -0- | NONE | -0- | ONE | -0- | -0- | 1 | -0- | |

| | BIRD SPE | # BIRDS | WT OZ 1 | CTY PRS | AIRPORT | LOCALE | US INCID | ENGINE | DASH | DMG CODE | SEVERITY | POW LOSS | MAX VIBE | THROTTLE | IFSD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -0- | -0- | -0- | YUL-SOF | YUL | MONTREAL QUE, CANADA | NO | CFM56 | 3 | A,H | 3 | NONE | 2 | -0- | NO | 4 FAN MID ACOUSTICAL PANELS REPLACED |
| | -0- | 1 | -0- | PLZ-JNB | XFO | SOUTH AFRICA | NO | JT8D | 17A | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| HAWK | 3K105 | 1 | 6. | -0- | MAF | MIDLAND/ODESSA, TEX | YES | CFM56 | 3 | A,B,H | 3 | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | ORD-BHM | BHM | BIRMINGHAM, ALA | YES | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | -0- |
| CUCKOO | 2R51 | 1 | 2. | AUS-DAL | AUS | AUSTIN, TEX | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | XFO | -0- | NO | JT8D | 9A | A,C | 3 | -0 | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | ZRH-AMS | ZRH | ZURICH, SWITZERLAND | NO | CFM56 | 3 | | -0- | NONE | -0 | -0 | NO | -0- |
| | -0- | -0- | -0- | BHX-FRA | BHX | BIRMINGHAM, ENGLAND | NO | JT8D | 15 | A,C | 3 | -0- | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | SCC | PRUDHOE BAY, ALASKA | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | BHX | BIRMINGHAM, ENGLAND | NO | JT8D | 15 | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -CBR | XFO | CANBERRA,A.C.T., AUSTRALIA | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| | -0- | 1 | 4. | JNB-PLZ | JNB | JOHANNESBURG, SOUTH AFRICA | NO | JT8D | 17A | | -0- | COMPRESSOR | -0- | -0- | NO | -0- |
| | -0- | -0- | -0- | -0- | XUS | -0 | YES | JT8D | 15A | A,G | 2 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -0- | BRU | BRUSSELS, BELGIUM | NO | JT8D | -0- | | -0- | COMPRESSOR | -0- | -0- | -0- | -0- |
| | -0- | 1 | -0- | TUL-STL | XUS | ST. LOUIS, MO | YES | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | FOUND DURING GRD INSPEC, ODOR IN CABIN |
| | -0- | 1 | 14. | CPT-PLZ | CPT | CAPE TOWN, SOUTH AFRICA | NO | JT8D | 9 | A,C | 3 | -0- | -0- | -0 | YES | -0- |
| | -0- | 1 | -0- | -0- | CMG | CORUMBA, BRAZIL | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0- | IGV AND COWL DAMAGE,1 FAN BLADE DAMAGED |
| | -0- | -0- | -0- | AUS-HOU | XUS | HOUSTON, TEX | YES | CFM56 | 3 | A,B | 3 | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| | -0- | 1 | -0- | -0- | BWI | BALTIMORE, MD | YES | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | AN EVENT |
| | -0- | -0- | -0- | -0- | XFO | -0- | NO | JT8D | -0- | A,G | 2 | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | ISG-OKA | XFO | JAPAN | NO | JT8D | -0- | | -0- | -0- | -0- | -0- | -0- | -0- |
| | -0- | -0- | -0- | -AKL | XFO | AUCKLAND, NEW ZEALAND | NO | JT8D | -0- | A,C | 3 | -0- | -0- | -0- | -0 | -0- |
| | -0- | -0- | -0- | CLE-IAD | CLE | CLEVELAND, O | YES | JT8D | 7 | A | 4 | NONE | -0- | -0- | NO | -0- |
| | -0- | 1 | -0- | -DEN | XUS | DENVER, COL | YES | JT8D | -0- | | -0- | NONE | -0- | -0- | NO | FOUND DURING GROUND INSPECTION |
| | -0- | 1 | -0- | -TSV | TSV | TOWNSVILLE, AUSTRALIA | NO | CFM56 | 3 | | -0- | NONE | -0- | -0- | NO | ODOR IN CABIN |
| | | | | | | | | | | | | | | | | OUTPUT SCREEN |

## APPENDIX C

## STATISTICAL HYPOTHESIS TESTING

Statistical analyses are based on an underlying probabilistic model of the processes that give rise to the data. For example, to provide the basis for comparing the weights of ingested birds in the United States and overseas it is necessary to hypothesize an underlying random distribution of bird weights. Statistical analyses are somewhat more sophisticated than descriptive data analyses and more care is required to ensure that the methods are appropriate for the data.

Statistical analysis is basically formalized inductive reasoning. Hypotheses about bird ingestion hazards are evaluated for consistency with the data that have been collected. Statistical analysis provides the rules for quantifying the level of consistency forming the basis for objective unbiased decisions. The process is known formally as statistical hypothesis testing, and a brief outline of the procedure is presented here.

The basis of a statistical hypothesis test is the hypothesis, which is a formal statement about a relationship in the data. In comparing the weight distributions of U. S. ingestions versus foreign ingestions, one hypothesis is that there is no difference in the sizes of the birds ingested here versus those ingested overseas. If the data are found to be consistent with the hypothesis it is accepted; otherwise the hypothesis is rejected.

The rules for deciding whether to accept or reject the hypothesis are based on the possible errors that could be made. A type I error refers to the situation in which the hypothesis is true; however we reject the hypothesis. Alternatively, when we accept the hypothesis when it is not true we commit a type II error.

The goal of the statistician is to minimize the likelihood of both types of errors. Unfortunately the likelihood of a type I error is reciprocally linked to the likelihood of a type II error so that lowering the likelihood of a type I error will increase the likelihood of a type II error. Since only one error can be fully controlled, it has become standard practice to control the likelihood of a Type I error, which is called the significance level of the test. The test hypothesis is chosen so that it should be accepted unless there is strong evidence that it is not true, and the test is constructed to minimize the likelihood of a type II error for the given significance level over a broad range of alternatives.

The mechanics of conducting a statistical hypothesis test are implemented by calculating a test statistic. The test statistic is a function of the data that are related to the test hypothesis. It is usually constructed so that small values are consistent with the null hypothesis and large values are consistent with the alternative hypothesis. The cutoff for accepting or rejecting the null hypothesis is called the critical value and is a function of the desired significance level.

Another aspect in evaluating the efficiency of a statistical test is its ability to detect when the test hypothesis is false. This ability is called the power of the test and is defined to be the probability of rejecting the test hypothesis when it is false. Generally there are many alternatives to the test hypothesis so that the power of the test is a function of the specific alternate hypothesis.

A variation on the statistical hypothesis test is the calculation of a confidence interval for a parameter such as the overall probability of ingestion (POI). Since there is no specific hypothesis about the POI, a confidence interval is used to describe the range of probabilities that are consistent with the data. The confidence level associated with a confidence interval corresponds to one minus the significance level of a hypothesis test and is a measure of the likelihood that the true value of the parameter (in this case the POI) is contained in the interval.